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The Fair.

ON Monday, February 17th, the doors of the British Industries Fair at Castle Bromwich and at Olympia will be opened, and between that date and February 28th, the closing day, there should be a considerable turnover of business in all kinds of British products.

While we are concerned, as any Trade Journal should be, with the well-being of all departments of British industry giving employment, we naturally lay emphasis upon the electrical and allied trades when we profoundly hope that there will be such gatherings of overseas inquirers and buyers, and such a selling efficiency displayed by exhibitors' representatives, that substantial orders shall be placed, many new trade connections made, and many business friendships formed, so that our industry shall feel the benefit for months to come.

May all this be the case, particularly at Birmingham, where the heavy (including the major portion of the electrical) products are housed, while Olympia may be expected to draw powerfully because, with altered and extended buildings, the part of the Fair stationed there enters upon a new lease of life with the prospect of its magnitude growing—well, we suppose in perpetuity.

We have not lost any of our earlier enthusiasm for this annual national trade boost—a quick-selling market of but a few days' duration, different from anything else in which the electrical trade indulges. It brings together all classes of visitors; some in group-convention; some from overseas; some who are mainly at Birmingham to see other goods but become interested in those of electrical character; and others who, stationed permanently in this country as merchants or buyers, attend as the agents of oversea purchasers who cannot come personally. They want to see the newest lines and to buy what their clients immediately need, or desire to stock, here or abroad. Such visitors come where they can be brought into touch with a great variety of manufacturers and representatives whom, without the Fair, they could only see by visiting many separate firms, electrical showrooms, or offices, and perhaps many towns. In the course of the eleven days they can, by utilising the post or the telephone, come into close contact with them.

Just a word of retrospect. Wembley's colossal 1924 British Empire Exhibition and its enormous expenditure cast a cloud over the Fair. This was not unnatural, but unfortunately by the middle of 1925 it looked as though the Castle Bromwich section, electrically at any rate, was going under. In response to a suggestion, the REVIEW went down from London to Birmingham and gave its assistance to the small faithful electrical group and others associated with the management and with the Birmingham Chamber of Commerce, visioning and urging the making of a good thing—one much required and greatly to be desired. A committee got to work, a commissioner approached potential exhibitors, and we placed the urgency of the matter before our readers every week, with the result that in 1926 there was a finer collection of British electrical products brought together than on any previous occasion. The movement became well-established; every year the display grew and improved; and our efforts continued to bear fruit in 1927, 1928, and 1929. This year, as already announced, we have shown our "live" interest by taking a Stand among the industry, and we dare hope that 1930 will repeat, or exceed, the successful experience of the last few years.

In order that such may be the case we urge our readers to fix their visiting days, and prepare their inquiries and orders in readiness, "right now."

Overseas Information.

ONE of the most modern, as well as the most ancient, pieces of advice that has been given to British manufacturers by trade authorities in high places counsels them to study the requirements of those with whom they wish to do business in overseas markets. We allude to this hackneyed question just now not for the purpose of again urging action, but in order to draw attention to a commendable effort which is being made by the Department of Overseas Trade to facilitate private visitation of such markets in search of trade.

We have before us a memorandum for the guidance of commercial visitors to the Argentine Republic, which has been prepared by the Acting Commercial Counsellor at H.M. Embassy at Buenos Aires, and issued by the above Department in London. This is the second example of an official business-cultivation pamphlet of the kind, the first to appear being one compiled last year relating to Canada. We believe it is intended that the pamphlet relating to Buenos Aires shall be followed by others concerning other South American States. There is every reason why South America should receive prominence in our overseas trade deliberations at the present time, for the potentialities of the market have been emphasised by the D'Abernon Mission, and, in addition and perhaps more important, the date of the great Buenos Aires Exhibition is drawing near.

For many years past we have been receiving inquiries from correspondents desiring to visit the overseas markets either on business or in order to take up posts offered to them. Particulars regarding the cost of living, climate, social customs, and general conditions formed the subject of a series of articles, but conditions are constantly changing, and information thus collected is apt to get out of date, making it necessary sometimes for us to refer our correspondents to the D.O.T. Inquiry Department. It has been found, both by us and by the staff of the Department itself, that its ability and willingness to vouchsafe such advice has been unknown to the general public, and one of our objects in giving the present prominence to this series of Official Pamphlets containing Hints for Commercial Visitors is to dispel ignorance regarding the existence of what we consider to be a very useful, if somewhat belated, piece of activity.

Manufacturers and traders interested in the British Empire Trade Exhibition, which is to be held at Buenos Aires from February to April, 1931, or travellers who are contemplating a visit to the Argentine Republic before that date, will do well to ask the Department (35, Old Queen Street, S.W.1) for a copy of No. 27,690/29, by Mr. E. J. Joint, the Acting Commercial Counsellor at Buenos Aires. It refers to the climate, advising one when to go, while it also particularises briefly steamship, currency, custom house, hotel, language, and other such matters which must be at hand when considering plans and fixing up arrangements.

Rural Service.

ONE might gather from comments in the lay Press that the countryside is actively demanding electrification on a large scale and that all supply undertakings need do is to extend their distribution systems to adjoining villages, when, without further effort on their part, big profits may be made. How far this is from the truth need not be told here, since those with experience of the subject know that rural dwellers are not as a rule prone to take the initiative in adopting new methods—intensify the technical and economic difficulties due to the scattered nature of the load. That the prospect for rural supplies has not until recently seemed very promising is due, in some part, to the prevalence of the economic doctrine that demand creates supply, whereas in any advanced stage of material civilisation it would be far truer to say that the supply must create the demand.

A will to take the initiative in helping consumers (and prospective consumers) to crystallise their views as to what electricity can do for them is an important feature of the activities of the Shropshire, Worcestershire, and Staffordshire Electric Power Co., as related in an article commenced on a later page. This initiative includes research into the applications of electricity, permanent showrooms, exhibitions, and *suitable* propaganda literature. It is, as the Newcastle-upon-Tyne Co. has also recognised (see "Electricity for the Home" section), a case of bringing Mahomet to the mountain. There are many other points worth emphasising in the means adopted by the Shropshire company for dealing with consumers, such as (1) a two-part tariff with a secondary charge low enough to enable electricity to compete with other methods; (2) simple hire of apparatus and deferred payment for wiring; (3) prompt and ready service; (4) making the best of the help that contractors can give; (5) regarding the undertaking primarily as an organisation for giving service to consumers; and (6) developing an atmosphere favourable to the undertaking by creating an interest in its work and by reasonable concessions to local feeling. In the opinion of the Shropshire company the adoption of such methods presents the only conditions under which rural electrification is economically possible. We agree.

The Fruits of Electrical Science.

AT the I.E.E. dinner last week we were reminded of the enormous changes in human conditions brought about by scientific progress during the past half-century—changes far greater in magnitude than had occurred in any equivalent period in the world's history. Of the forces that have produced these effects, electricity is, of course, easily the most important. Most of us remember evenings before the advent of broadcasting; a smaller number can recall life in a big city without electric light in theatres, shops, factories, and homes, without electric trains and tramcars, when workshops, large and small, were driven by steam engines, and when a telephone call was a particularly exasperating experience. It is a commentary on the adaptability of the species to its environment, that those who have experienced conditions before electricity was in general use, no less than the younger generation, should be prone to complain of trifling details of expense in connection with any of the electric services. Often it is only a matter of a few shillings a year that separates us from the dark ages, and this expenditure should be compared with the far larger sums spent without hesitation on things which make very little difference to our enjoyment of life.

Frequency Change Problems.

A review of the various schemes for arranging changes of induction motors, and a guide to their selection.

By PERCY HUGGINS, A.M.I.E.E., Assoc.A.I.E.E.

IT is in the common interest of supply authorities, motor manufacturers, electrical contractors, and consumers that the standardisation of frequency at 50 cycles per second during the next few years, in accordance with the Electricity Commissioners' schemes, shall not in any way restrict in the meantime the installation of motors in those districts where the frequency of supply is now 25 cycles. To supply motors for 25 cycles, and at the same time provide for their ultimate changeover to 50 cycles, presents a problem having both technical and financial aspects demanding careful attention. The following solutions are variously offered.

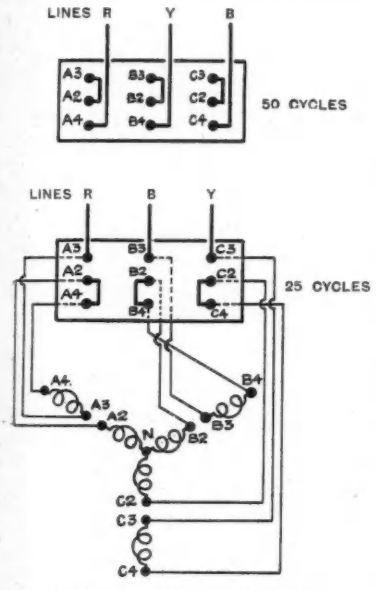


Fig. 1.—Connections for Auto-transformer Starting.

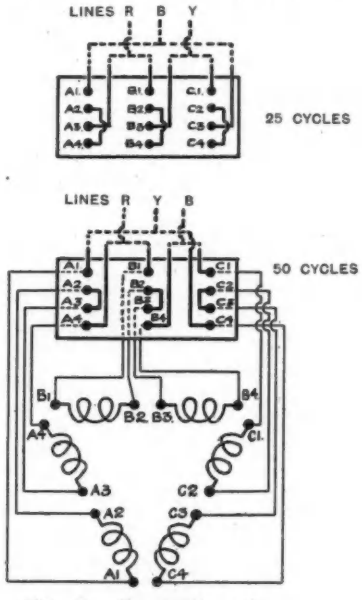


Fig. 2.—Connections for Star-delta Starting.

Part Exchange Scheme.—Motor manufacturers tender a perfectly standard single-frequency 25-cycle motor with an undertaking to replace it with a new standard 50-cycle motor whenever the changeover is made. Interchangeability of the two motors is assured by the maker's guarantee that the replace motor will be of the same essential dimensions as regards shaft extension, height of centre, foundation bolt holes, &c., as the 25-cycle motor; and further, that the motors are so designed in the matter of having similar slip-ring volts and amperes, &c., that the starting gear will be suitable for both frequencies (with the exception of no-volt coils, which have to be changed or altered with any scheme). For this exchange a definite charge is arranged, which is payable at the time the changeover is made.

Before proceeding to consider those alternatives which adapt the same motor for both frequencies, it is useful to review certain fundamental rules.

To convert from 25 cycles to 50 cycles with constant speed it is necessary to double the number of poles. The total magnetic loading, and hence flux density in the airgap, remains approximately constant at both frequencies, so that the flux per pole at 25 cycles is double that at 50 cycles. Therefore salient core dimensions must approximate to those of a single-frequency 25-cycle motor, in order to accommodate in the iron at the back of the stator and rotor teeth the 100 per cent. extra flux per pole at 25 cycles. Standard 25-cycle stampings commonly have fewer slots than the standard for 50 cycles, so that use of the former would lead to low power factor on 50 cycles.

When the same winding is used for both frequencies, whether adapted by internal or external reconnection, it is physically impossible to make the pitch of the coils the most economical for both frequencies, and this necessitates a larger motor, and lowers the apparent efficiency (*i.e.*, power factor × output/input).

As a squirrel-cage rotor has no definite number of poles, but automatically adjusts itself to the number of stator poles, such a rotor can be designed suitable for both frequencies without alterations. The windings of slip-ring rotors need alteration, as indicated below, to adapt them to altered frequency.

The Dual-frequency Motor. — The dual-frequency motor offers the attractive feature that it is possible, by simply altering its terminal box connections, to change the number of its poles in such a way as to retain substantially the same power capacity and speed at both frequencies.

Such a motor usually has only one stator winding, with which a two to one pole change ratio is obtained by

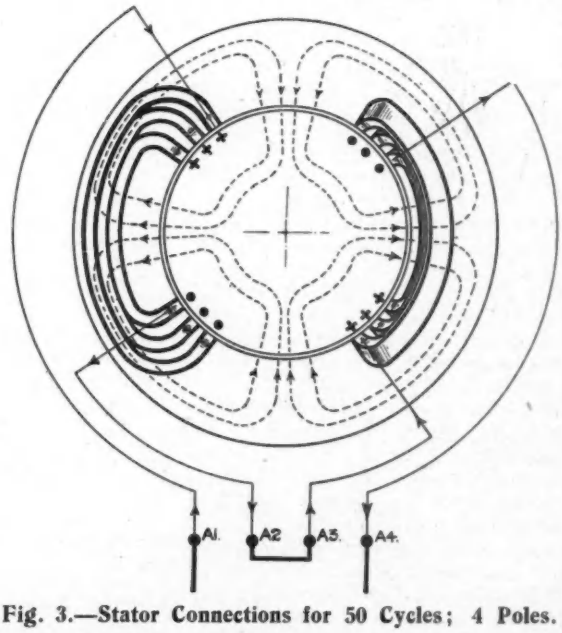


Fig. 3.—Stator Connections for 50 Cycles; 4 Poles.

reversing alternate coil groups in each phase. The simplicity of the changeover operation is made clear by

figs. 1 and 2, which show the alterations in the connections in the terminal box for direct-on starting (or auto-transformer starting), and star-delta starting, respectively. It should be noted that it is necessary to reverse phases Y and B when changing the polarity in order that the direction of rotation may remain the same.

General ideas on windings arranged for this system of pole changing, and of their merits and demerits, may be gathered from a study of figs. 3, 4, and 5. Either concentric or two-layer windings may be used.

In fig. 3 of a 2/4 pole concentric winding, only the coils of one phase are shown, connected for 4 poles, the current direction and resultant 4 pole flux formation also being ascribed. If one coil is reversed as shown in fig. 4, the two coils combine to produce only two poles, but the winding is 50 per cent. short pitch on the smaller number of poles. Departure either way from full pitch renders the coils less effective, the amount which a coil side in each slot contributes to the resultant total e.m.f. varying as the cosine of its angle (in electrical degrees) from the centre of the phase group per pole. Assuming the stator shown in fig. 4 has 36 slots (*i.e.*, 10 deg. per slot pitch) this disadvantage of short pitching, represented by the " distribution factor " K is as follows :—

2 slots × cosine angle 35° = 1.638
2 slots × cosine angle 45° = 1.414
2 slots × cosine angle 55° = 1.148

6 slots giving effect of only = 4.2

Therefore $K = 4.2/6 = 0.7$;

and $N = E \times 10^8 / 0.7 \times 2.22 \times n \times C$

where N = Flux per pole,
E = Back e.m.f. in volts per phase,
n = Frequency in cycles per second, and
C = Number of conductors in series per phase.

In order to apportion the disadvantage between the 25-cycle and 50-cycle conditions, the windings may be of the double layer type as shown in fig. 5, for which

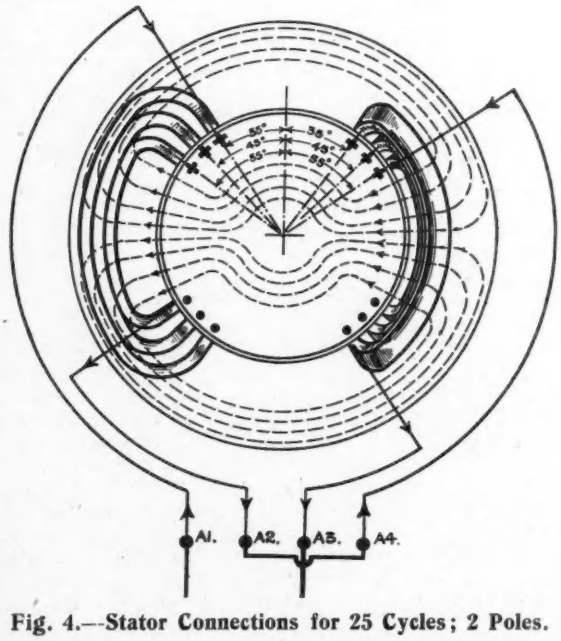


Fig. 4.—Stator Connections for 25 Cycles; 2 Poles.

the distribution factors are 0.76 for 25 cycles and 0.808 for 50 cycles. With dual-frequency motors, and those arranged for internal reconnection, the facilities offered by a double layer winding for varying the coil pitch are used to give effect similar to adjusting the number of turns, so that the respective characteristics on 25 cycles and 50 cycles can be more finely balanced, and, if desired, adjustment made for a change in line voltage, such as 440 volts, 25 cycles to 400 volts, 50 cycles.

Dual-frequency motors have been built with two separate stator windings, but the necessity of locating one winding away from the stator bore, usually combined with extra deep slots to accommodate the two windings, results in that winding having a large leakage factor and poor power factor. This disadvantage and their high cost usually put two winding stators out of favour. Two separate windings are used more frequently for the rotors of dual frequency slip-ring motors, in which case only three slip-rings per rotor can still be used by means of special adjustable slip-ring connectors.

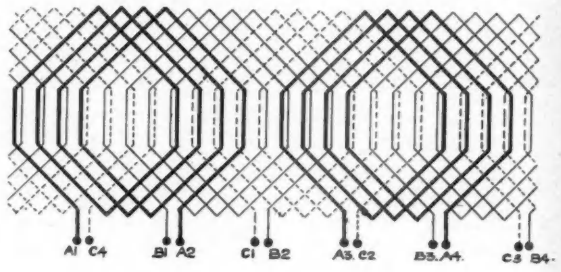


Fig. 5.—Dual-frequency Winding.

The greater simplicity of squirrel-cage dual-frequency motors, compared with those having slip-ring rotors, justifies the adoption of the former wherever possible.

Internal Reconnection of Individual Coils.—In this scheme the motor has a two-layer stator winding, which is special to the extent that the coil pitch lies midway between the respective full pitches of the 25-cycle and 50-cycle poleages. The motor is first supplied with the individual coils connected in the best way for 25 cycles; at change-over the motor is dismantled, and the individual coil connections are altered to suit 50-cycle supply. This effects the best compromise as regards the respective distribution factors and field forms at 25 and 50 cycles; fig. 6 illustrates this, by showing how the coils of the dual frequency winding shown in fig. 5 could be better employed by internal reconnection of the individual coils than is possible with mere external reconnection of half phases *en masse*. The distribution factor of the reconnected winding (fig. 6) is 0.933 as compared with 0.808 for the dual frequency winding (fig. 5). The rotor winding of slip-ring motors can be treated in an exactly similar way to the stator winding.

Complete Rewind.—A motor may be supplied suitably wound for 25 cycles with a view to rewinding completely for 50 cycles. This procedure has the advantage over internal reconnection of individual coils in that coils of the most efficient pitch (usually full pitch, but sometimes short pitched to about 66 per cent. of full pitch for 2-pole and 4-pole motors) are used for both frequencies, thus making for a slightly smaller motor, lower first cost, and more favourable apparent efficiency.

Temporary Frequency-changing Plant.—A 25/50 cycle frequency changer may be used temporarily to permit of the installation, in the first place, of 50-cycle motors, &c. This scheme is exceptional, and could only be contemplated for the complete new equipment of a factory or large extension.

Frequency standardisation will proceed more rapidly in some areas, such as Glasgow, than in others, of which Birmingham is an example; a scheme is contemplated for transferring 25-cycle motors released from the former areas to be held available for any use to which they can be put in districts still requiring temporary 25-cycle plant. Facilities arranged by the Electricity Commissioners in this direction should solve the dual frequency problem in a small percentage of cases.

Table I is a brief study of the most important factors governing the selection of a motor to meet the frequency change problem.

The Financial Side.—The Weir Committee estimated that £8,000,000 would have to be expended on frequency standardisation, which sum the Electricity (Supply) Act of 1926 provides shall be defrayed by the Central Electricity Board. The Board will be repaid by the Elec-

tricity Commissioners, who in turn are empowered to recover it by a levy on all supply authorities substantially in proportion to their revenue; the consumer negotiates his claim with his supply authority.

Every scheme for frequency changeover of a motor is bound to involve an extra cost over that of a standard single-frequency 25-cycle motor of from 25 per cent. to 50 per cent., and no one scheme can claim sufficient advantage over another as regards total cost to render that alone the deciding factor. The costs of frequency change may be incurred variously in the first installation cost of a motor, or at the time of frequency changeover. With the "part exchange" scheme it is all incurred at the time the changeover is made; with dual frequency motors it all figures in the initial installation cost; while, with complete rewinds and internal reconnection, it is usually apportioned between initial installation and changeover. Often supply authorities do not arrange payment of their part of the expenses until such changeover is made, in which case extra cost incurred in anticipation of a frequency change by the consumer at the time of initial installation is capital locked away waiting the opportunity to be reclaimed when the changeover is made in anything up to five years' time. It is a wise precaution for the consumer to obtain present-day market prices for perfectly standard 25-cycle motors as a basis on which to estimate his claim, the items of which should be made *prima facie* by the motor makers' invoices and quotations.

Performance and Reliability. — It must be remembered that it still remains with the consumer or his consultants to ensure efficiency and economy in the *use* of electricity. If, owing to frequency change, the consumer is saddled with plant a few per cent. less efficient than it could be, he will probably pay for the frequency change during the life of the motor many times the amount paid by the supply authorities. For instance, with a 20-horse-power motor and power at 1d. per unit, every one per cent. lower apparent efficiency in most cases adds at least £1 to the annual power bill. The relative importance of high power factor and efficiency largely depends on the amount the motor is used, and this is a factor of which the consumer must take full account. When faced with the frequency change problem, the motor buyer should always, in his own interests, request comparative power factor and efficiency figures in his inquiries for motors.

The peculiarities in the field forms of dual-frequency stator windings tend to lower static torque and running-up torque with squirrel-cage motors, particularly on 25 cycles. This tendency can be offset by working with a heavier flux or increasing the effective rotor impedance,

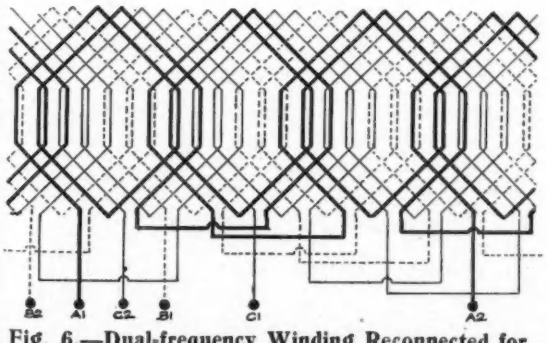


Fig. 6.—Dual-frequency Winding Reconnected for 50 Cycles.

but these expedients lower the apparent efficiency of the motor. The relative importance of this feature should be judged from the makers' torque guarantees considered in conjunction with the power factor and efficiency figures.

There is no reason why every scheme considered herein should not have the highest security against breakdown. Certainly reputable makers of dual-frequency motors do adequately reinforce insulation wherever it is in any way rendered desirable by the special features of their machines.

Ease of Changing Over.—It is generally desired that the changeover shall be made easily and quickly, so that there shall be minimum interference with the running of plant. For this reason complete rewinds and internal reconnections are seldom favoured, because either course almost invariably necessitates return of the motor to the maker's works. The value of the part exchange scheme as regards ease of changing over largely depends on the circumstances. The new 50-cycle motor can be got on site ready for date of changeover, but exchange of motors may still present difficulties when a large number have to be dealt with in one factory, or when the motors are installed in positions difficult of access, such as cranes, capstans, mines, &c., where often gears and other parts would have to be dismantled in the process.

TABLE I.—A GUIDE TO SELECTION.

A indicates the Best Possible.
B indicates Very Good.
C indicates Moderately Good.
D indicates Least Favourable.

Scheme.	First cost, based on price of standard 25-cycle motor.	Total cost, based on price of standard 25-cycle motor.	Time necessary to change over.	Apparent efficiency compared with standard single-frequency motor.
Part exchange ...	A. 100%	D. 135/150%	B. 30 minutes upwards	A. 0%
Dual-frequency motor	D. 130/145%	C. 130/145%	A. 5 minutes	D. -2% to -6%
Complete rewind	B. 105/110%	B. 130/135%	D. 7/14 days	B. 0% -2%
Internal re-connection	C. 115/125%	A. 125/130%	C. 5/10 days	C. -1% to -4%

Starting Apparatus.—In conclusion, it may be mentioned that starting gear of any type is generally suitable for changeover from 25 cycles to 50 cycles without alteration, with the exception of the no-volt release coils. The latter must be either of a dual-frequency pattern, arranged for changeover by series-parallel reconnection, or replaced. Auto-transformer starters designed for 25 cycles will operate satisfactorily on 50 cycles, although the reverse would not be the case.

New Electrical Installations in France and Algeria.

The French Ministry of Public Works has authorised the Société de la Force et Lumière des Pyrenées to undertake the electrification of the Artigues waterfall on the Adour le Garet, and the equipment of a hydro-electric station. A reservoir will be formed by means of a barrage 11 m. high at an altitude of 2,035 m., and will provide about 250,000 m³ of water per day through a subterranean canal 2,076 m. long. The station will be placed at an altitude of 1,203 m., and at the outset it will have a capacity of 9,000 kW. Permission has also been granted to the Société de Transport d'Energie Electrique de l'Est for the creation and exploitation of a transmission line between Graffenstaden (Bas Rhin) and Logelbach (Haut Rhin), and between Graffenstaden and the thermal station at Port du Rhin. A further concession authorises the Société Algerienne d'Eclairage et de Force to construct and exploit distribution lines, sub-stations, and transformers, but not to generate electricity, which will be supplied by a station now being constructed at Alger. La Société Est Electrique has obtained a concession to establish and to operate a distributing system, sub-stations, and transformers in La Meuse and the Ardennes; electricity will be supplied from an outside source at 3-phase, 5,000, 15,000, and 45,000 volts.

Real Rural Development.

Being an account of the remarkable achievements of the Shropshire, Worcestershire, and Staffordshire Electric Power Company in sparsely-populated portions of its area.

THE area of supply of the Shropshire, Worcestershire, and Staffordshire Electric Power Company covers some 2,500 square miles, and includes almost the whole of Worcestershire and parts of the eight counties of Shropshire, Stafford, Warwick, Gloucester, Hereford, Oxford, Radnor, and Brecon. This area contains many large towns, such as Smethwick, with a population of more than 80,000, Kidderminster, Dudley, Redditch, Evesham, and others with populations varying from 25,000 to 50,000. In many parts, however, particularly in the newly-equipped districts, the population is very sparse, and the problem of electrifying small townships, villages, and detached houses and farms has been for some four or five years an important feature of the company's operations. The company is in a favourable position for pursuing a forward policy with regard to the smaller consumers, since under its Acts it is permitted to distribute electricity for lighting, &c., as well as for motive power over its entire area.

Generation and Transmission.

The principal source of electricity is the large modern power station at Stourport of which an exterior view is given in fig. 6. Particulars were given of this station and of the main transmission system in the ELECTRICAL REVIEW for June 10th and 17th, 1927. The only new feature is the addition of a 25,000-kW, 3,000-r.p.m. B.T.H. turbo-alternator and a boiler with an evaporative capacity of 100,000 lb. per hour. The new plant is designed for 50-cycle working, and is interconnected with the original sets through 25-cycle 5,000- and 1,250-kW B.T.H. frequency changers. A portion of the turbine room is illustrated in fig. 12. This station is, of course, "selected" for operation under the grid scheme, as is also Smethwick, the older station of about 30,000 kW installed capacity. A third station, at Redditch, is also working. The output from these generating stations is approximately 150 million kWh per annum, and the maximum demand on the system is close on 50,000 kW.

Main transmission is at 66, 33, and 11 kV, overhead for the greater part, the total route length of such lines being 410 miles. Transmission to every point is in duplicate (usually by two separate routes), except where an emergency supply is obtainable from another undertaking. Interconnections for stand-by supplies have been made with the Birmingham Corporation, the West Gloucestershire Power Co., and the Wessex Electricity Co., and similar arrangements are in hand with regard to the West Midlands J.E.A. and Worcester Corporation. The system is controlled from the Halesowen sub-station in a control room of a type common to large undertakings. The control engineers, who are responsible directly to the management, are stationed in a soundproof office, shut off from the main room (fig. 11).

Having regard to the extent of its overhead system, the company has considered it necessary to install a wind-recording gauge on the roof of the head office at Mucklows Hill, near Halesowen. During the recent high winds the maximum velocity recorded was 68 m.p.h. It is the practice of the company to keep the route of the lines clear of trees for a distance of 30 yards, and more on the south-west sides if possible, in view of the direction of the prevailing winds; nevertheless, two or three interruptions of supply were caused by broken branches being blown on to the lines. For protection against lightning a few oxide-film arrestors are in use, but reliance is more usually placed upon the use of cable sections in series with the lines.

The considerable mileage of overhead construction in use has involved the negotiation of 2,300 wayleaves, while sub-stations and sites for works for consumers have necessitated the opening of a special department for looking after the 220 individual estates acquired.

Two agreements are entered into for each wayleave; in the first, on an easement basis with the landowner, the rental varies only with the type of support; in the other, with the tenant, the rental varies also with the kind of land traversed. Little trouble has been experienced by the company in securing wayleaves, and, although this part of the country is strewn with some of the finest examples of old Tudor buildings and thatched half-timbered cottages, no factitious outcry against the destruction of amenities has arisen. The event has justified the contention of those who advocate overhead construction that there need be no fears on this score when reasonable care is taken; in a tour throughout the area, no case was observed in which the steps taken to alleviate the drudgery of the countryman by electricity could offend the susceptibilities of the most fastidious urban dweller seeking the picturesque.

Acquired Undertakings.

The Shropshire Company has for the past few years pursued the policy of acquiring undertakings established within its statutory area, and very definite advantages are claimed in each instance in which such an undertaking has been absorbed.

In the first place, it has been necessary in almost every instance to reconstruct a considerable portion of the overhead distribution systems of these undertakings, in order to bring them into line with the Electricity Commissioners' regulations for securing the safety of the public. A policy of reconstruction on the scale requisite becomes financially possible only when backed by the greater resources of the larger organisation.

These isolated undertakings have been invariably operated on the direct-current system, but when acquired by the Shropshire company are changed over to alternating current working on the 3-phase 4-wire system at the standard frequency of 50 cycles. The company's policy is to introduce a bulk supply by extending the high-voltage network. In this way a full and comprehensive service becomes available, as, with the increased power resources, domestic demands for cooking and heating can be met readily, and power demands also catered for on economic terms.

Of the many small undertakings acquired by the Shropshire Co. and dealt with in this manner reference may be made to the following four cases as being typical: (1) the unauthorised undertaking at Bromyard, in Herefordshire; (2) the unauthorised undertaking at Upton-upon-Severn in Worcestershire; (3) Church Stretton in Shropshire, working under a Special Order, the assets of which were acquired by the Shropshire Co.; and (4) Tewkesbury, in Gloucestershire, a limited company operating under a Special Order, the share capital of which was acquired by the Shropshire Company, although the Tewkesbury Co. continues to supply under its own name.

In each instance reconstruction of the distribution system took place immediately, and, with a view to inducing a wider use of electricity for all purposes, deferred-payment wiring and hire schemes were made available; under the latter cookers, heaters, water boilers, and

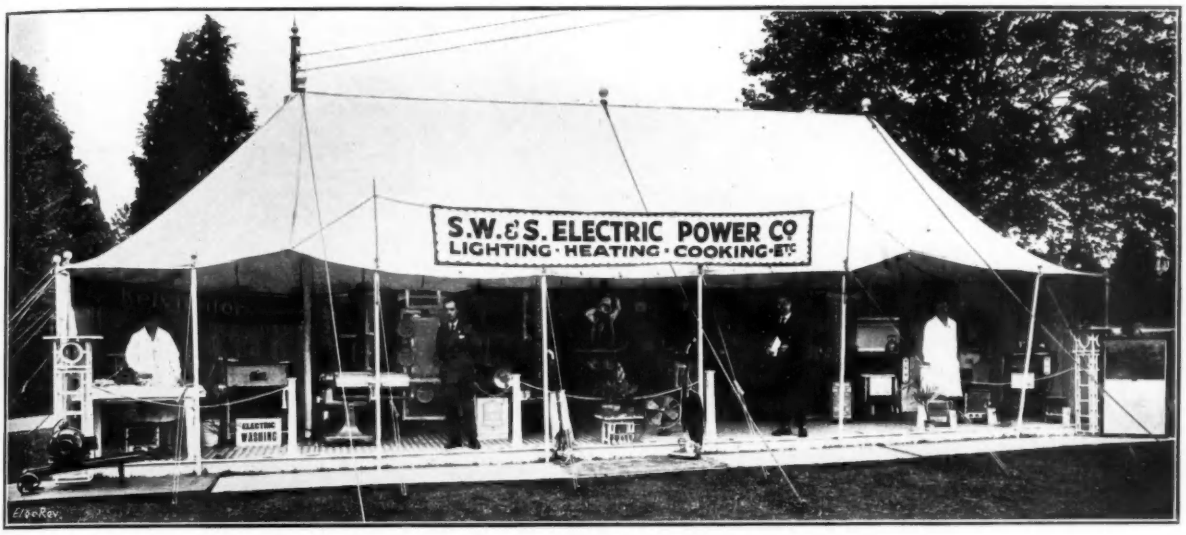


Fig. 1.—An Electrical Exhibition near a Worcestershire Village.

Fig. 2.—Rural Sub-station.

Fig. 3.—A Showroom in an Industrial Town.

Fig. 4.—Soil Warming by Electricity.

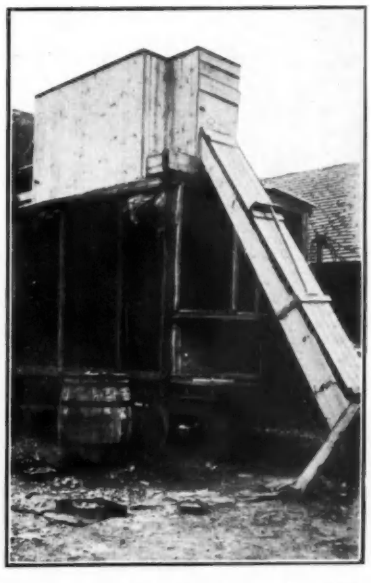


Fig. 5.—Drying Hops by Electricity.

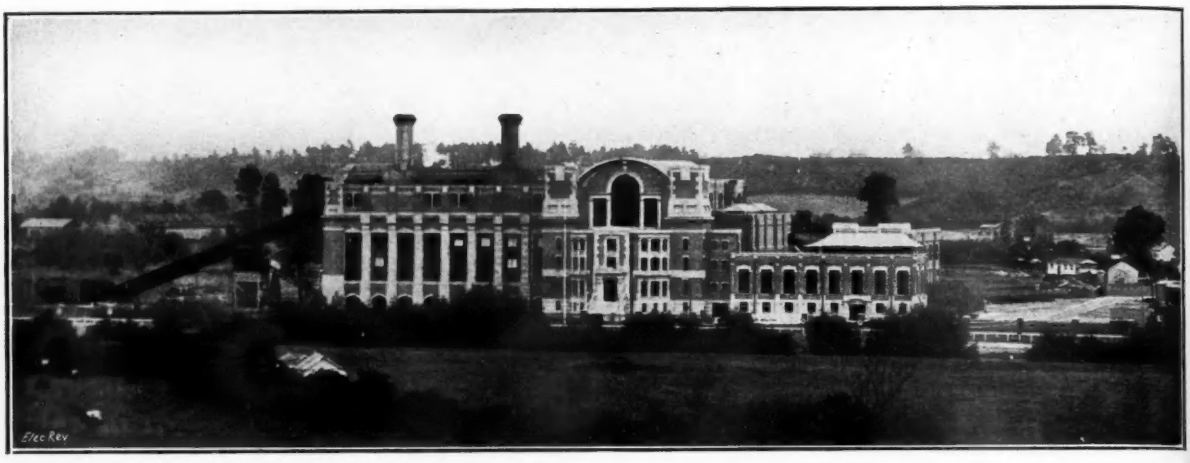


Fig. 6.—Exterior View of Stourport Generating Station.

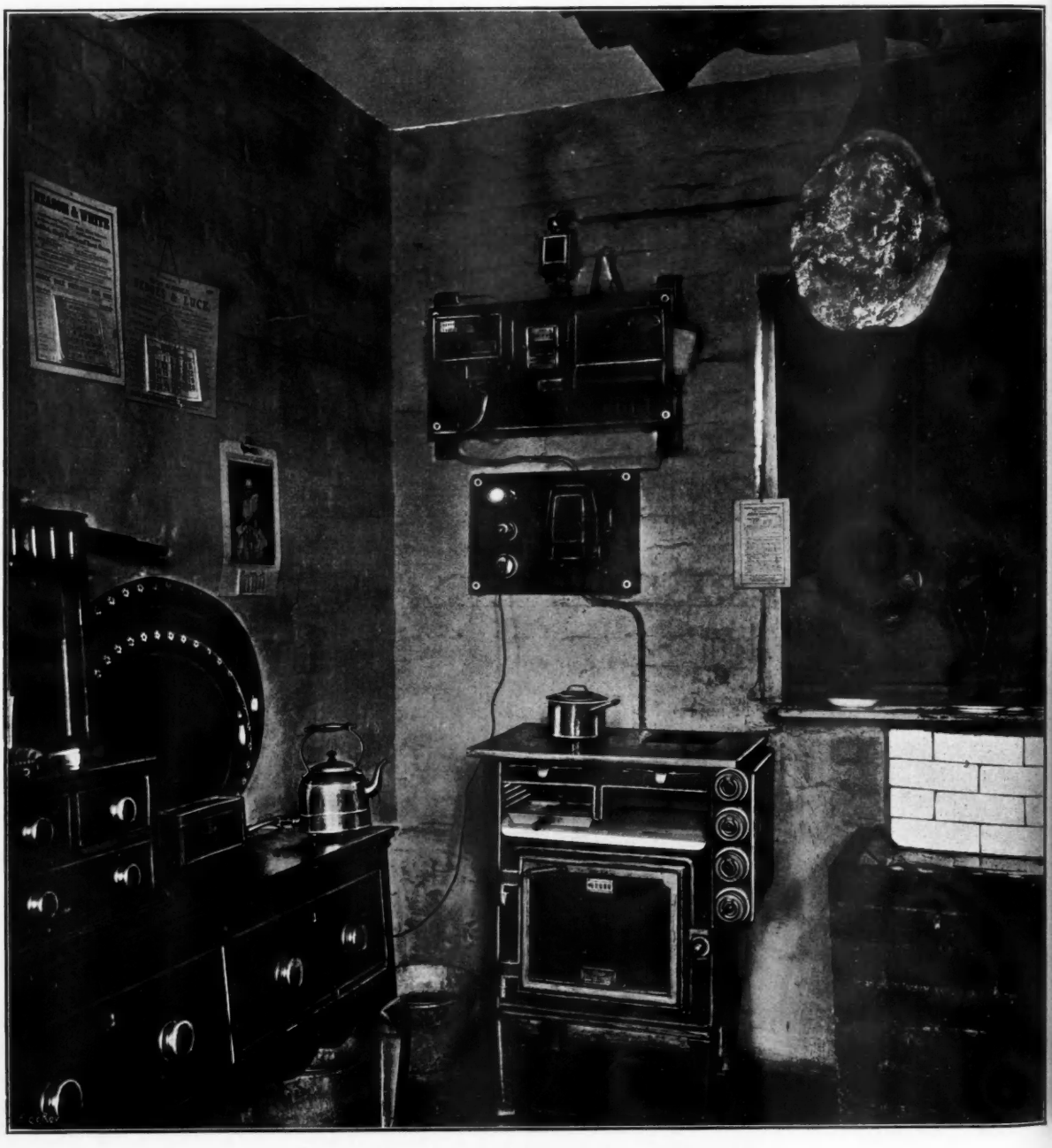


Fig. 7.—Farmhouse Kitchen with Electric Cooker.

Fig. 8.—A Showroom in Old Ludlow.

Fig. 9.—A Multi-purpose Pole.

Fig. 10.—Root-pulping and Chaff-cutting Plant.

Fig. 11.—The System-control Room at Halesowen.

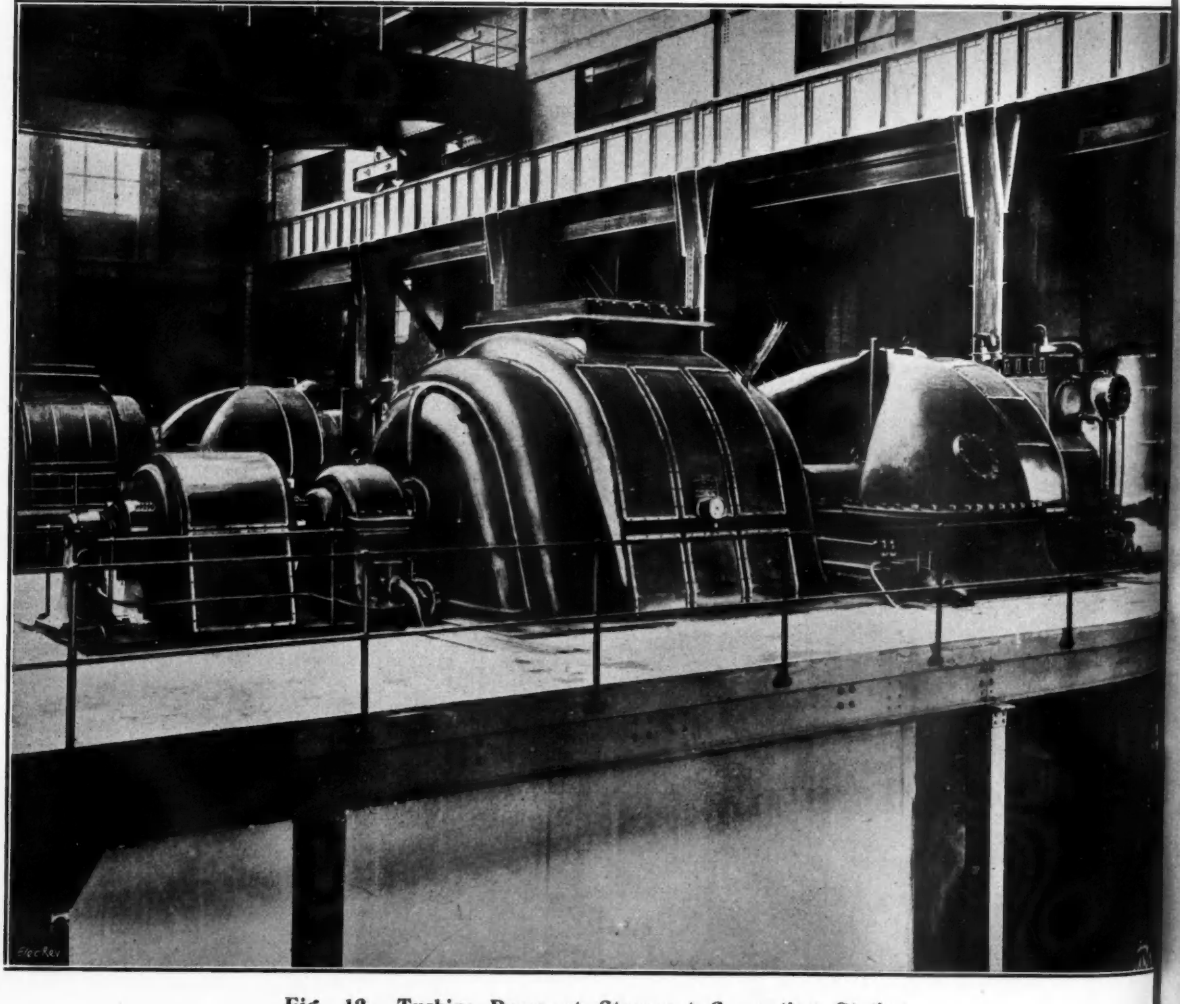


Fig. 12.—Turbine Room at Stourport Generating Station.

similar domestic apparatus, and motors and transformers for works could be taken on simple hire terms (including free maintenance).

The prices, which were between 10d. and 1s. per kWh for lighting and 3d. and upwards per kWh for power and domestic heating and cooking, were reduced to the standard tariff applicable in towns of similar characteristics, namely: 7d. or 8d. per kWh for lighting; 1½d. per kWh for domestic heating and cooking; and 2d. per kWh, graded to 1½d. according to consumption, for industrial power. In addition, two-part tariffs for residences, retail premises, and factories were introduced.

Bulk supplies were carried to the undertakings from the company's main transmission lines as soon as possible, and it is a significant fact that the kWh sold per annum have increased by the following percentages: Upton, 300 per cent.; Church Stretton, 70 per cent.; and Tewkesbury, 105 per cent. The number of consumers has increased in the same three towns, respectively, by 150 per cent., 25 per cent., and 66 per cent., in the space of approximately two years. Bromyard is quite a recent acquisition, and in consequence the growth of the business is not yet ascertainable, although the indications are favourable.

The company's publicity methods, including the distribution of literature, the holding of exhibitions, demonstrations of the use of apparatus in the various showrooms, and travelling exhibitions, are referred to in more detail later in this article. These methods have undoubtedly had an effect in fostering a wider appreciation of the use to which electricity can be put with economy, in the home, in the workshop, in traders' premises, and in connection with agriculture.

It may be noted that the Shropshire company does not use its powers under the Electric Lighting Acts with regard to the limit to which free service connections are provided. Ten yards of underground cable or 30 yards of overhead line is always provided free of charge, whether on the public highway or on private property. This policy is generally of considerable advantage to new consumers, compared with the conditions previously prevailing.

High- and Low-voltage Distribution.

The intermediate voltage chosen for rural work is 11 kV, transformed from primary voltages at sub-stations in which both high-voltage switchgear and transformers are out of doors. In some instances an intermediate voltage of 3,300 V has been adopted, with 0.025 sq. in. copper conductors, chiefly with a view to enabling high- and low-voltage distributors to be erected on the same supports; the cost is £420 per mile. Constructional work is carried out by British Insulated Cables, Ltd., under the supervision of the company's mains department, which is also responsible for all high-voltage line maintenance. An interesting departure from normal practice is the use of galvanised steel conductors for 11-kV lines. The conductors are of "Crapo" steel, manufactured by Messrs. Richard Johnson & Nephew, Ltd.; it had previously given great satisfaction when utilised for stay wires, as it was reported to have a considerably longer life than ordinary galvanised steel Galvanised steel is used not so much on account of its low cost relative to copper as for its superior tensile strength, which allows longer spans. The conductors are 7/12 and the 28-ft. poles are spaced 210 ft. apart at a cost of £440 per mile, including survey and wayleaves. Although the g.s. 11-kV line is thus slightly more expensive than the 3,300-V copper-conductor line, the net cost is usually less owing to less expenditure on transformers and switchgear. As an example, with a five-mile line feeding on route three distribution points, two of 50 kVA and one of 30-kVA capacity, a 11-kV scheme would cost £3,352 and a 3,300-V scheme £3,506; these figures are for the schemes complete and ready to serve the three low-voltage systems, and include capitalised wayleaves, acquisition of land, supervision, and establishment charges. The total route length to-day of overhead transmission lines (chiefly 11 kV) in rural areas is 350 miles; of this total 60 miles was constructed in 1928, 80 in 1929, while the company's programme includes the construction of 120 and 135 miles in each of the next two years.

The standard method of tapping a line for giving low-voltage supplies is by means of a cable from the cross arm through a carbon-tetrachloride switch-fuse to a Brush transformer which, if of more than 20 kVA output, is three-phase and is placed on a concrete slab, together with the wooden structure containing the M.E.M. 400-volt switchgear, the whole being surrounded by a wood or steel-spiked paling and rendered as unobtrusive as possible (fig. 2). In the case of tappings for less than 20 kVA, single-phase pole-mounted Brush transformers are used. Owing to the growth of the system the duty of the fuses has increased, and in some cases they may be called upon to interrupt 100,000 kVA. Arrangements are therefore in hand to substitute oil-immersed switch-fuses of the English Electric Co.'s make for the carbon-tetrachloride fuses, whenever the conditions require it.

Where underground distribution is in existence, as in towns with frequent services, a brick-built sub-station is used to house all apparatus, although the transformers are again, for standardisation, of the outdoor type. Generally speaking, overhead low-voltage distribution is employed in the villages, and nowhere can it be considered objectionable from the æsthetic point of view. Fig. 9 indicates how a pole supporting conductors may be put to other uses, *i.e.*, a public lamp standard and a direction post.

In October last, which was said to be a typical month, 773 underground and 132 overhead services were put in, though the proportion between the two varies considerably in different months. This work involved the laying or construction of 8,096 yards of underground and 3,164 yards of overhead services, and 15,963 yards of underground and 1,883 yards of overhead 400-volt distributors.

The standard size of service has a cross-sectional area of 0.0225 sq. in., and, when an electric cooker is installed, two phase wires and the neutral are taken into the premises. Distributors are of 0.1, 0.15, and 0.2 sq. in. conductors, 400-volt, 3-phase, 4-wire.

Utilisation of Electricity.

In the industrial area of the company such diverse industries as collieries, rolling mills, heavy stampings, general engineering, and the manufacture of carpets, chemicals, fish-hooks, and needles, are among its consumers. The conditions of supply are similar to those obtaining in similar areas of other large progressive undertakings and need not be touched on further. In the more sparsely inhabited districts the undertaking relies chiefly on the domestic load, especially cooking and heating, but there is also a number of power users which play an important part in making the scheme an economic success. The latter include pumping stations (from 2 to 725 h.p.), sewage works, flour mills, fruit canning (a summer load), and various small village industries, which the availability of electricity is reported to have appreciably stimulated.

Lighting is the first demand of the countryman, but, given proper tutelage, this is soon followed by a desire to make fuller use of the opportunities offered.

Next in popularity is electric cooking. Thus, in the Evesham district, where the soil is intensively cultivated for such produce as Brussels sprouts, asparagus, plums and other fruit, the small-holder works with his family on his 12 acres or so of land throughout the daylight. The holding is often situated at some distance from his home in the village or hamlet, and daylight hours are too precious to spend in preparing food and eating. Before the advent of electricity the housewife was of necessity up long before dawn to light the fire and prepare breakfast for the family, whom she then had to join in the fields. The ease with which water can be boiled and breakfast cooked by electricity is worth money as well as comfort to such folk.

(To be continued.)

Electricity for the Home.

Spreading the "Electrical Idea"; The Newcastle Companies' Movable Showroom.

WHEN an electricity undertaking has a very extensive area and wishes to make its service known in all parts it usually opens branch showrooms or holds periodical exhibitions in the more important towns and villages. The Newcastle-upon-Tyne Electric Supply Co., Ltd., and its associated companies, have already carried out work on these lines, but they have recently added to their system a very effective showroom which is not fixed to one spot, but can be taken all over the area. The necessity for such a scheme can be realised when it is known that the companies have a *clientèle* of 80,000 people scattered over an area of 4,000 square miles. It is a case in which the parable of Mahomet and the mountain is peculiarly applicable.

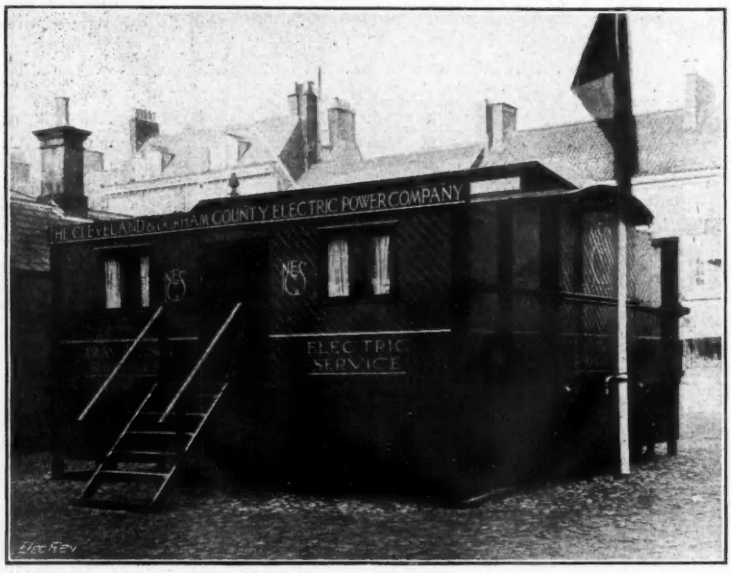


Fig. 1.—The Exterior of the Travelling Showroom.

We reproduce herewith two views of the travelling showroom, which, it will be seen, bears the name of the Cleveland and Durham County Electric Power Co., and the monogram of the Newcastle Company. The vehicle is built on similar lines to those of an ordinary trailer caravan, except that, having reached its destination, by the simple expedient of extending the side walls, the showroom can be expanded to cover a floor area of more than 400 sq. ft. The interior is panelled in mahogany with two fireplaces to match. A glass showcase 6 ft. by 3 ft. by 2 ft. occupies the centre of the floor, and a mahogany desk of similar dimensions is placed in one corner. A 40-gallon water tank to facilitate the demonstration of electric water heaters is fixed to the exterior at one end. A mains driven radio set provides music, &c., for visitors. The full range of apparatus hired out by the companies, *e.g.*, cookers, radiators, irons, water heaters, &c., is not only carried on board but is also actually shown in operation. In addition there is the usual showroom equipment of vacuum cleaners, coffee percolators, floor polishers, "Thermega" blankets, and dozens of other pieces of electrical apparatus with which a large percentage of consumers in rural areas is not familiar.

In the showroom all wiring, which is concealed behind the mahogany panels, has been carried out with Henley's "Nomet" cable and arranged as two separate installations, each complete with ironclad double-pole main switch and distribution board; these are fixed in a box under the centre portion of the showroom. In this switchbox are additional plugs for inspection lamps and to provide energy for floodlighting units. All plugs for radiators, cookers, standard lamps, &c., are of the Reyrolle earthing type, and similar plugs have been fixed on the movable sections so that after the showroom is erected these are connected together and energy is then available.

A supply of electricity from the nearest overhead (or underground) distributor is taken by means of a 4-core armoured trailing cable, connected to a 4-pin Reyrolle watertight plug and socket underneath the showroom, and a similar socket is fixed on the pole carrying the overhead line or in a suitable box underground. The connections to this socket are so arranged that when the plug on the trailing cable is connected, the supply of energy will be either single-phase or balanced across two phases as required.

Two trained salesmen constitute the permanent crew of the travelling showroom, but additional canvassers are employed to carry out intensive sales campaigns during the time the showroom is open, usually of about fortnightly duration. Very little difficulty is experienced regarding sites for the itinerant electrical shop as the local authorities willingly co-operate.

The showroom was built by the Howcroft Carriage and Engineering Co., West Hartlepool; wired by Edgar Phillips, Ltd., of the same town; equipped with electrical apparatus from Carliol House, Newcastle-upon-Tyne; put into service by the Newcastle-upon-Tyne Electric Supply Co., Ltd., and Associated Companies; and it is greatly appreciated by the large numbers of consumers in outlying districts who have visited it.

Fig. 2.—A View of the Interior.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

High-frequency Portable Electric Tools.

The CONSOLIDATED PNEUMATIC TOOL CO., LTD., Egyptian House, 170, Piccadilly, W.1, claims to be able now to offer electrical portable machines which in most respects are even better than air tools. These "Hicycle" portable tools operate on high-frequency (180-200 cycles) alternating current, three-phase, 125 volts. It is claimed that by using 200 cycles, as against 50 cycles, four times the power is obtained for the same weight of machine. As the tools are provided with squirrel-cage induction motors, the machines possess the additional advantages of that type of motor.

The windings are composed of a special alloy containing all desirable electrical characteristics, and are cast solid with the rotor. The rotors are claimed to be practically indestructible, and this innovation alone saves a great deal of money which would otherwise be spent on rewinding armatures and fitting new commutators and brush gear. The speed of these machines does not fall away as soon as load is applied, but remains constant. The operations covered by "Hicycle" tools include drilling, reaming, nut running, screw driving, tapping, stud running, grinding, buffing and sanding. The illustration, fig. 1, shows a "Hicycle" sanding machine for smoothing up large flat surfaces. This machine has long been needed, particularly in the motor car industry, and is now doing excellent work. The high-frequency current for these machines is provided by a frequency changer or motor alternator set, the former when a.c. mains are available, and the latter for direct-current circuits.

Fig. 1.—A "Hicycle" Sanding Machine.

A New Ceiling Rose.

We have recently had the opportunity of examining the new "Ramie" porcelain ceiling rose which has been put on the market by Mr. J. MARTIN BLAIR, M.I.E.E., Audrey House, Ely Place, E.C.1. This new ceiling rose consists of a single high-grade earthenware cover having an earthenware bridge or grip at the back, through which the flexible wires are threaded to take the weight of the fitting. Ordinary wooden blocks can be used, through which a 1¼-in. hole has to be cut, or, if contractors wish to avoid this trouble, blocks can be purchased suitable for the job. The manufacturers claim a more satisfactory job than can be made with an ordinary rose, in so far that the ceiling rose itself can be threaded up on the bench or floor, so that it is only necessary to connect it up to the main wiring system by the use of "Ramie" connectors. A further claim made is that with the use of this type of ceiling rose absolute electrical continuity is obtained, as there is no possibility of leakage as the result of screws fixing the electrical wires on to the base of the ceiling rose itself. The makers also claim that as there are no small screws to negotiate, in a very awkward position, very considerable time will be saved in connecting up. Fig. 2 depicts the method of connection for the rose.

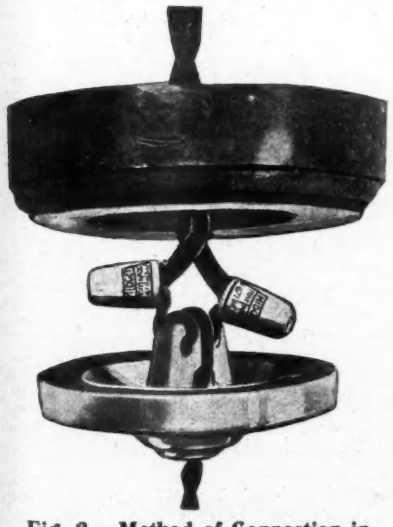


Fig. 2.—Method of Connection in "Ramie" Ceiling Rose.

A Power-factor Compensator.

A production of the ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2, comprises machines primarily intended for application to new or existing induction motors. They may be driven by an independent motor or coupled to the main motor by direct or belt drive. Their purpose is to generate an e.m.f. at slip frequency and to impress this on the rotor circuit of the main induction motor, so as to correct the power factor of the rotor and consequently of the stator also. The revolving part of the machine consists of an armature and commutator similar to that of a d.c. exciter, but with the difference that the winding span is shorter to suit the three-phase connections. This armature runs in a laminated stator having main poles, commutation poles and compensating windings; the number of main poles is three or a multiple of three. Normally, the fields are of the compound-wound type, the ends of the shunt-field coils being connected across the brush arms through an adjustable resistance. The armature is supported in roller bearings and the shaft is extended to take a half-coupling or pulley. The speed adopted depends on the particular performance required, and it may be from 1,000 to 3,000 r.p.m. As the rotor circuit operates at low frequency the compensator has only to force the exciting current through a low impedance. Consequently its voltage need only be low, and the kVA required by the compensator is only a fraction of the lagging wattless kVA of the stator, because in the latter case the exciting current requires a much higher voltage owing to the circuit being at line frequency. An important feature is that the field windings are normally so proportioned that the power factor is practically constant over the whole load range. The machine is therefore self-regulating and does not require a shunt regulator, although a regulator can be supplied if considered necessary in a particular case.

A compensator to give unity power factor at full load will probably meet the majority of cases, and it is of importance to note that the most efficient use of the apparatus is made when the power factor correction is carried to between 0.95 lagging and 0.95 leading at full load. Compensation of the power factor beyond 0.95 leading can be obtained in most cases if required, but the particular circumstances would call for special investigation. The English Electric power factor compensator, fig. 3, can be applied to any make of slip-ring induction motor, from, say, 200 h.p. to 2,500 h.p., which normally runs without external resistance in the rotor circuit.

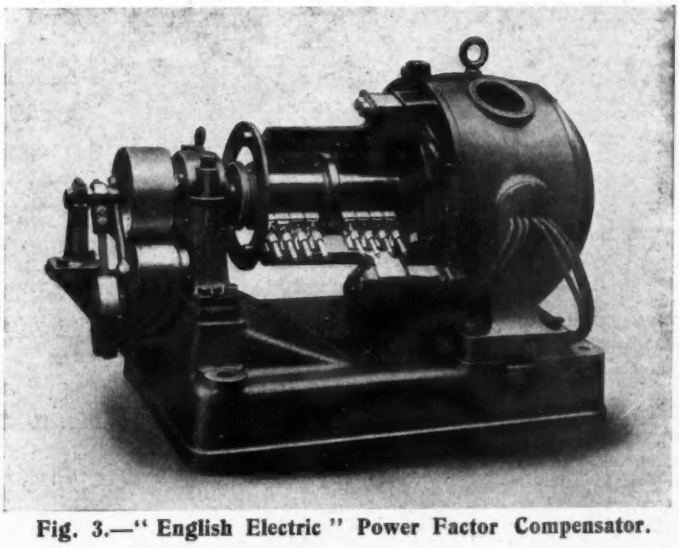


Fig. 3.—"English Electric" Power Factor Compensator.

Some New Radio Instruments.

Brief descriptive details of methods and apparatus developed for extra-high-frequency, radio, and gramophone pick-up purposes.

(*Extracts from papers read before the* Wireless Section *of the* Institution of Electrical Engineers.)

At the February meeting of the Wireless Section of the Institution of Electrical Engineers, which was held at the City and Guilds (Engineering) College in London, a series of five short papers was presented for consideration. The papers were not formally discussed, but the apparatus described in them was demonstrated in the College laboratories, in which most of the experimental work described in the papers was carried out. The following are extracts from the papers :—

A High-frequency Ammeter.

A paper by Prof. C. L. Fortescue, O.B.E., M.A., M.I.E.E., and Mr. L. A. Moxon describes the construction and theory

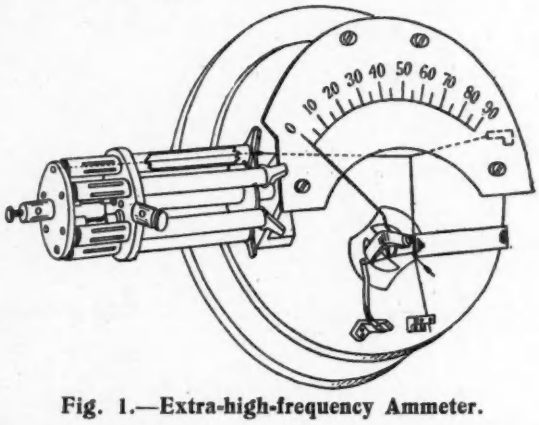


Fig. 1.—Extra-high-frequency Ammeter.

of a simple form of hot-wire ammeter that is intended for use at any frequency up to 100 million cycles per second. It is made in a cylindrical form in order that the correction factors for various frequencies may be calculated with certainty. The paper contains data of an instrument that has actually been constructed; its impedance is relatively low and the r.m.s. value of the current is indicated directly by the movement of a pointer over a scale.

The construction of the meter is shown in fig. 1. Each of six parallel wires (each carrying a maximum d.c. of about 1.2 amperes for the full-scale deflection) is kept in its central position on the axis of a screening tube by means of a flat spring at the end. One of the wires is directly attached to what is normally the heated wire of an ordinary hot-wire ammeter. As the wire in the tube expands and contracts, the pointer of the instrument moves to and fro over the scale and the movement thus becomes a measure of the current in the heating wires within the screening tubes. A symmetrical arrangement of the terminal connections ensures uniform distribution of current between the heated wires.

For some experimental work this first instrument has been used with only one screened heating wire, which was quite satisfactory for the experiments, but the terminal capacity is much greater than need be the case with a simple wire, and consequently the corrections are abnormally large. A second heating unit having only a single wire is now under construction. The terminal capacity is estimated to be only about one-fifth of that of the 6-wire heater, with the result that the corrections will be more normal.

The initial calibration is by direct current in the ordinary way, and the scale is marked from that calibration. The capacity between the terminal blocks and the screening tubes is measured before the wires are inserted; this, and the dimensions, enable the corrections to be made, the actual value of the alternating current entering the input terminal for each scale division being thus found and plotted for use as a correction curve. Alternatively, curved scale divisions may be used.

The corrections are very small for frequencies below 10^7, and from that frequency downwards d.c. calibration can be used with errors not greater than 1 per cent. Above that frequency, however, the correction increases rapidly owing to the relatively quick increase of the resistance, and also because of the increasing current in the terminal capacity. The impedance of the instrument increases with the frequency, and the reactance is inductive up to frequencies considerably above 10^8. With the cylindrical construction the dimensions have little influence on the corrections, and there is consequently a fairly free choice which enables the design to be adapted to the other requirements of the hot-wire instrument.

There is now in progress a lengthy research, which includes both the design of the instrument and the method of comparing the results with those of other similar ammeters and indirect methods of measuring current. It is being carried out under the auspices of the Department of Scientific and Industrial Research, by whose permission this paper is published.

Mechanical Impedance Measurement.

A paper by Prof. E. Mallett, D.Sc. (Eng.), M.I.E.E., and Mr. R. C. G. Williams, B.Sc. (Eng.), Graduate I.E.E., outlines a method of determining mechanical impedance. The device (for example, a gramophone pick-up, the mechanical impedance of which at a given frequency is to be measured) is driven by one prong of an electrically-driven tuning fork and the other prong is loaded to restore balance, the load required being the mechanical impedance to be determined; the skeleton circuit used is shown in fig. 2. The balance condition is indicated by the absence of vibration of the fork support.

An improvement depends upon the experimentally determined fact that mechanical resistance out-of-balance does not appreciably affect the support vibration. If the prongs are balanced for mass, the total resistance can be found from a decay-factor determination, or by a single measurement of amplitude with a known current, and the resistance of the device estimated.

The method has so far been tried only at the low frequency of about 100 cycles per sec., but no difficulty is anticipated in obtaining results at frequencies up to, say, 500 cycles per sec. with forks of higher pitch. It is hoped to extend the frequency range still further by employing the higher modes of vibration of the fork.

A New Gramophone Pick-up.

The paper by Mr. G. W. Sutton, B.Sc., describes the results of an experimental investigation into the performance of certain types of commercial gramophone electrical pick-ups, the majority of which leaves much to be desired; his investigation has led to a new design being evolved. He is concerned with the type used with standard broadcast radio-telephone receivers and loud-speakers, which should provide an output of the order of 0.15 volt per mm. per cycle per second (measured from the positive to the negative peaks of the amplitude of the needle-point displacement) in order to comply with the present tendency in receiver design.

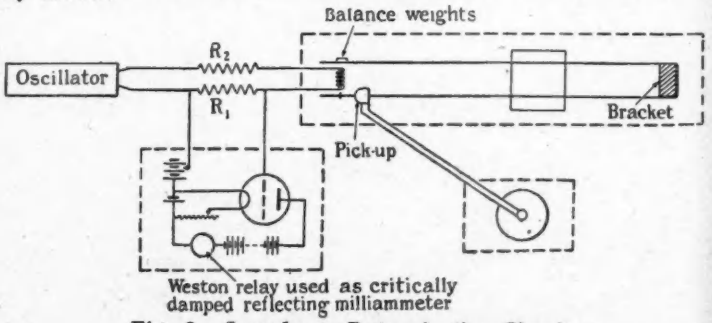


Fig. 2.—Impedance Determination Circuit.

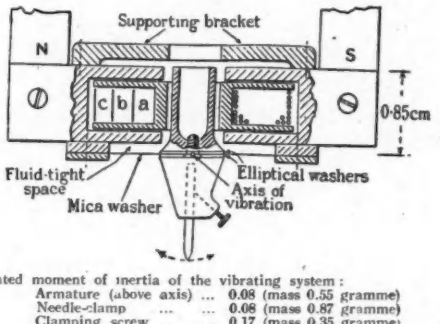
The technique of recording has so advanced that the frequency range covered is now such as to call for reproducing apparatus capable of dealing properly with frequencies down at least to 50 cycles per sec and up to the region of 8,000

cycles per sec. In the author's opinion the importance of the lower frequency limit is still not fully appreciated. Also the amplitude of the groove has been increased, at least in the better-class records, which means that the ratio of recorded note amplitude to that of those unavoidable irregularities which give rise to surface noise or "scratch" has been increased. Full advantage of this can only be taken by the use of electrical pick-ups, since some control of the volume of the output becomes necessary. In fact, there have been many protests from musically inclined listeners who use mechanical sound-boxes against the excessive volume obtainable from good modern records.

Considerations of voltage output and cost of production led the author to conclude that the moving-iron electromagnetic type of generator was the only one likely to prove satisfactory. In designing this type one has to choose between the "attracted reed" and "balanced armature" patterns and the latter appears to possess two distinct advantages. First, the resultant forces of magnetic attraction on the armature are smaller, and therefore do not necessitate the use of such a high order of stiffness in the armature suspension. Secondly, a comparatively much larger amplitude or armature vibration can be allowed without introducing "rectification" effects in the voltage output. These two points allow a very useful margin of freedom in deciding the dimensions of the armature and pole-pieces and of the constants of the principal vibrating system.

Preliminary tests brought out the following points:—

(1) The existence in every case of one, or more, "resonant" points in the voltage characteristics. The prominence of



Calculated moment of inertia of the vibrating system:

Armature (above axis)	...	0.08 (mass 0.55 gramme)
Needle-clamp	...	0.08 (mass 0.87 gramme)
Clamping screw	...	0.17 (mass 0.35 gramme)
Needle	...	0.12 (mass 0.19 gramme)

a, *b*, c=coil wound in three sections of 2,000 turns each.

Fig. 3.—Gramophone Pick-up.

these peaks varied considerably, and in some cases so affected the output that when the instrument was used for the reproduction of speech and music clearly noticeable distortion resulted. It appeared to be probable that corresponding damage was caused to the record. (2) A tendency, with some pick-ups, for the needle to jump out of the groove at frequencies below about 100 cycles per sec. In all cases distinct vibration of the tone-arm, or supporting lever, could be felt at low frequencies. (3) A comparatively poor voltage output at frequencies of 5,000, 4,000, and sometimes even 3,000, cycles per sec., which leads to a distinct lack of "brilliance" in speech and music reproduction.

The reason for the peaks in the characteristics is not at first clear. It is true that at a certain frequency the reaction force due to the moment of inertia of the vibrating armature is balanced by that due to its method of suspension, leaving only frictional or damping forces at play. This, however, should only increase the amplitude of vibration at that frequency *for a constant deflecting force*. When the needle-point rests in the groove of a record the amplitude of excursion of the point is governed, however, by the record, and the deflecting force adjusts itself accordingly. Consequently, providing the armature is rigid and the needle-point does not leave the groove, there is no reason why there should be a peak in the voltage characteristic at this frequency. To explain the existence of the peak, therefore, it is necessary to assume either that the armature is not rigid or that the needle itself bends very considerably. Equations of the motion of the vibrating armature of a pick-up show that the position on the scale of frequency of the principal resonance is governed by the inertia of the armature and the sum of the stiffness of the armature suspension and of the needle. In a well-designed instrument the stiffness of the suspension will be small, compared with that of the needle (of the order of one-tenth), so that the latter is virtually the governing factor; in fact, the only means available to the designer to raise the principal resonance to a high figure (as suggested) is to reduce the armature inertia. Also a state of resonance arises at a very low frequency, the pick-up vibrating as a whole about the point of the needle and the pivot of the tone-arm or lever. This frequency is governed by the stiffness of the suspension and the inertia of the body of the pick-up about the axis of suspension of the armature. It is not difficult, therefore, to reduce it to so low a figure that its effect is of no importance, by increasing the mass of the pick-up and its support. Except for the two resonant conditions just mentioned there appears to be no reason why the amplitude/frequency characteristic of the armature of a pick-up should not be a horizontal straight line up to the point at which it is no longer justifiable to assume it to be a rigid structure. The inertia of the pick-up about the support pivots should be large and also the suspension control constant should be as small as possible so that the bearing pressure on the needle may be reduced to a minimum.

The reasons for adopting the balanced-armature system have already been given; it remains to deduce the best dimensions and constants for the vibrating system. Its most important single property is its moment of inertia, and every effort must be made to reduce it to a minimum. It is an advantage to suspend the system at its mid-point, since for a given mass this leads to the lowest moment of inertia and also facilitates the application of additional damping.

The commercial instrument's inertia constant I is much too high (1.5 gramme-cm².). The experimental armature was therefore designed so that I should not be more than 0.5 gramme-cm²., by making the armature portion hollow (see fig. 3). A given mass distributed in the form of a hollow cylinder or rectangular block will possess much greater rigidity than the same mass in the form of a rod, and two further advantages accrue from this construction. Skin effect would in any case restrict the flux to the surface of the armature at the higher frequencies; hollowing it out will therefore tend to produce a more uniform characteristic, while the greater diameter of armature involved lengthens the magnetic paths straight from pole-face to pole-face for a given length of air-gap between armature and pole-face. The hollow in the armature has also been used for coupling the system with rubber or oil (*i.e.*, "capacity" or "resistance" coupling) to a second vibrating system mounted above the first, to provide increased damping.

The armatures in the experimental models subsequently built were mounted on mica disks, as shown in fig. 3, since it is non-magnetic and has a high stiffness/mass ratio. Moreover, having decided on a suitable thickness (0.010 in. was employed finally) the disks are easily made to specification and are very uniform in their properties.

In order to prevent motion of the armature in a plane parallel to the pole-faces due to irregularities in the record groove, two elliptical washers were clamped into the positions shown in fig. 3. The minor axes of these were made equal to the armature diameter and the major axes were made about twice as long, which rendered the stiffness of the support in the plane parallel to the pole-faces nearly twice that in the plane of normal armature vibration. The mica disk was clamped at its outer edge between two heavy rings, with carefully turned flat faces, and these in their turn were bolted to the pole-pieces (fig. 3).

The thickness of the disk was adjusted until it was just sufficient to prevent the armature sticking to the poles by magnetic attraction. The value of the suspension control constant T was then found to be 13.8×10^4 dyne-cm. per radian, which is a little more than half the value for the commercial instrument previously tested. It appears probable that at high frequencies the effective value of T increases, due to the mode of vibration of the disk an the resilience of the air in the cavities around the armature; T should have as small a value as possible, to reduce the tendency for the needle to leave the groove and the consequent wear and tear on the record at frequencies of the order of 100 cycles per sec. At these low frequencies the effective value of T approximates much more closely to 13.8×10^4 (obtained statically) than 30×10^4 (obtained dynamically at 1,000 cycles per sec. and over), which is confirmed by the comparative freedom of this model from tone-arm vibration at 100 cycles per sec.

That the value of T (measured statically) was sufficient to prevent amplitude distortion is indicated by the linear relationship between the deflecting torque and angular displacement for the armature, up to values far in excess of the amplitudes obtained in operation, even at low frequencies. The air-gap length was about 0.3 mm., whereas the maximum amplitude of displacement of the armature in the gap was about 0.05 mm.

Having thus determined I and T, the remaining important quantities are the mass of the pick-up itself and the bearing pressure on the needle: the former should be as large as possible (of the order of 300 or 400 grammes), while the latter should be no more than is sufficient to prevent the needle leaving the groove at the lowest frequencies and the largest amplitudes of vibration. These conditions may be fulfilled by connecting the pick-up very rigidly to a massive and rigid supporting lever. The weight of the lever should be so disposed about its pivots that the bearing pressure on the needle is about 100 grammes.

It will be seen from fig. 3 that the construction of this model leaves a space above the mica disk and around the armature which may be rendered liquid-tight by varnishing, and may then be filled with oil of suitable viscosity to provide the necessary additional damping.

Valve Oscillator Stabilisation.

There is no need to stress the importance of definitely fixing the frequency of radio transmitting stations. The ordinary valve oscillator has advantages, such as ease of frequency adjustment and simplicity of apparatus, not

possessed by mechanical oscillators, and, were it not for the frequency drift commonly encountered, it would undoubtedly be far more used as a stabiliser to provide the necessary grid swing of the power valves.

A paper by Prof. E. Mallett, D.Sc., M.I.E.E., describes how the addition of a series inductance of suitable value to the anode circuit of a valve oscillator results in the frequency of the oscillations generated being independent of fluctuations in the valve constants. The effect is to bring the grid and anode voltages into exact phase opposition, thus making the frequency of the maintained oscillations the same as that of the free undamped ones of the oscillatory circuit.

The experiments were carried out with the assistance of Mr. C. R. Urwin and Mr. W. J. E. Tobin, and showed that a smaller value of inserted inductance than that which theory indicated would suffice. The correct value depends upon the frequency; the stray capacities may be such that the value required is negative, *i.e.*, capacity must be added, or, intermediately, it may just happen that the circuit is already stabilised at the particular frequency in use.

Experiments are being continued with a view to ascertaining whether the triode circuit modified in this way can take the place of the tuning fork or quartz crystal. Mechanical vibrators are always placed in a thermostatic chamber to avoid frequency-changes due to temperature-changes; it would equally be necessary to place the whole of the oscillatory circuit of the electrical oscillator in a constant-temperature chamber.

Response Curve Recording.

A paper by Prof. C. L. Fortescue, O.B.E., M.A., M.I.E.E., and Mr. F. Ralph describes the combination of a projection oscillograph with a special amplifier and a variable condenser coupled to the rocking mirror of the galvanometer, by means of which the response curves of electrical circuits can be thrown on to a screen for observation or recorded photographically.

The amplifier may also be used with the oscillograph in the ordinary way for low-frequency observations, the amplifier then functioning as a special form of valve voltmeter to give an output suitable for operating the oscillograph.

The horizontal deflection of the spot is made dependent upon the frequency change, and the vertical deflection is dependent upon the amplitude of the output of the circuits under test. The curve is repeated some 10 or 15 times per second, just sufficiently rapidly for the normal persistence of vision to give the impression of a continuous curve, which is projected on to a small screen in view of the operator adjusting the circuits. The effects of changing any particular variable are thus immediately seen. Photographic apparatus of the usual type can also be used for recording all response curves of sufficient interest to justify the time and expense involved. In addition, the terminals are so arranged that the low-frequency parts of the instrument can be used for converting small voltages into currents large enough to operate the oscillograph. This is useful in such cases as the measurement of leakage fluxes where even an oscillograph current would cause appreciable changes in the flux being measured.

The capacity in the oscillating circuit is in two parts. One part consists of a variable condenser adjusted by hand in order to give the correct mean value of the frequency, the appropriate inductance having been decided upon beforehand. The second part consists of a motor-driven variable condenser made up of two sets of fixed vanes and two sets of moving vanes, the latter being mounted on a long extension of the shaft of the driving motor. The two parts of the double condenser are in series and, as the vanes rotate, the capacity varies from maximum to minimum and back again during one revolution. This arrangement has the advantage that there are no sliding contacts in the high-frequency circuit. It has the disadvantage, however, that the moving vanes are not at earth potential, and consequently an insulating coupling must be used to connect the condenser spindle to the motor shaft. An extension of the condenser spindle carries a cam operating the usual rocking mirror of the oscillograph.

Proposed John Morris Memorial.

A suggestion has been made by a large number of friends of the late Mr. John Morris that some action should be taken to provide a permanent memorial as an expression of their great regard and appreciation of his life's work. Mr. Morris was chief of the engineering department of the Royal Technical College, Salford, from the time the college was built to his retirement ten years ago, and he was president of the Salford Technical and Engineering Association from its inauguration in 1891 until his death in October last. It has been decided that a prize or prizes shall be awarded annually to the student or students of the Engineering Department of the Royal Technical College whose work and examination results during the evening courses for the ordinary national certificate show the greatest merit. Subscriptions for the proposed memorial are invited to be sent to the treasurer of the fund, Mr. Richard Halliday, 239, Walkden Road, Worsley.

Legal.

Colliery Companies' Action Against a Power Company.

IN the Chancery Division on February 4th, Mr. Justice Clauson had before him an action on behalf of the Imperial Navigation Coal Co., Ltd., and the Cynon Colliery Co., Ltd., Cardiff, against the South Wales Electrical Power Distribution Co., Ltd., for a declaration that the defendant company, under an agreement of July 9th, 1925, was liable to pay them £6,154 with interest from January 1st, 1925, and was not entitled to a set-off in respect of any debt due for electricity supplied.

The defendant company counter-claimed for payment of a minimum sum of £300 per month for electricity, a declaration that £2,247 was due to it and a third declaration that the Cynon Company, in ceasing operations in 1925 on the sale of the Duffryn Rhondda Colliery, created a repudiation by the plaintiffs of a joint obligation which entitled the defendant company to claim the present worth of the unpaid minimum of the monthly sums due.

Mr. J. F. W. BEAUMONT, for the plaintiffs, said the amount which he was claiming was the last two instalments of a debt due to the plaintiffs under certain agreements. He did not think it was disputed that the debt was due to the two plaintiff companies jointly, but the defendant company claimed a set-off. The Imperial Company had gone into liquidation and its assets had been sold and there would be nothing for the unsecured creditors. Shortly before the agreement of July, 1925, the Cynon Company ceased to take any electricity. The material clause in the agreement stated that in consideration of the defendant company paying to the plaintiff companies the sum of £19,500 which the two companies paid towards the erection of the power lines to the two collieries, the net sum due for electricity supplied was agreed at £7,195, and that sum should be treated as the first instalment already paid by the defendant company. The balance was to be paid in four yearly instalments. The defendant company said in effect: "We are prepared to pay the two companies the amount they have spent but we are not going to be concerned with the accounts between the two companies. We are going to pay jointly and we are also going to lump together the debts which the plaintiff companies owe us and treat it as a joint debt and deduct it from the joint liability. We are going to pay them £12,500 jointly." But there was nothing in the agreement to show that the companies were to be jointly liable for the electricity supplied to either.

Mr. SIMONDS, for the defence, contended that the defendant company was entitled to damages from the plaintiff companies because of their failure to take £300 worth of power per month, which was the minimum agreed upon. They had not taken any power since 1925.

His Lordship said he thought that the pleadings might be gone into again to clarify matters, and it was arranged that the case should stand over with liberty to amend the pleadings.

British Talking Pictures, Ltd.

IN the Companies' Winding-up Court on February 3rd, Mr. Justice Maugham heard the petition of the Chloride Electrical Storage Co., Ltd., for an order for the compulsory liquidation of British Talking Pictures, Ltd.

Mr. C. TURNER, for the petitioners, said the petition was supported by creditors for £47,508 and opposed by creditors for £94,000. A committee of creditors had been appointed who believed that the assets of the company, which were substantial, would best be preserved by an adjournment and an arrangement.

Mr. LIONEL COHEN, K.C., for the supporting creditors, said they supported the proposal for a month's adjournment and for the appointment of a provisional liquidator in the meantime.

Counsel for the opposing creditors agreed to this course.

Mr. COHEN said that as the result of the scheme that had been adopted it was hoped that all the creditors would be paid in full.

His Lordship assented to the arrangement.

Mr. COHEN mentioned that among the creditors supporting the petition were the General Electric Co., Ltd., Radio Instruments, Ltd., and the Plessey Co.

Gramophone Cabinets, Ltd.

MR. Justice Maugham, in the Companies Court last week, again had before him the petition of the London Electrical Co. for an order for the compulsory liquidation of Gramophone Cabinets, Ltd.

For the petitioners, Mr. SIMONDS said that it had been suggested that, as the result of certain actions, the respondent company would obtain money, but the petitioners were not satisfied with that.

Mr. CHRISTIE, for the respondent company, said its liabilities were £5,000 and it had obtained judgment for £10,000 against another company which could not be enforced at present. The latter company had a substantial claim against a third company which, if successful, would result in the respondent company's creditors being paid in full. He asked for a month's adjournment.

His Lordship assented.

Breaches of Electricity Regulations.

AT Morley, Yorks., on February 3rd, Charles Scarth & Sons, Ltd., were summoned for breaches of the Electricity Regulations under the Factory & Workshops Act.

For the prosecution, it was stated that the case arose out of the death of an employé at the defendant company's mill in December last. The man was attending a hydro extractor, and in switching off the current he received a fatal shock at 400 V. When the apparatus was examined it was found that the switch to cut off the current was 200 yards away; also the earth wire had been broken and coiled up.

A solicitor for the defence said that although these regulations were made no steps were taken to see that they were carried out, and a Home Office official said that there were four electrical inspectors for the whole of England and Scotland.

On the major charge, negligence to take the necessary precautions whereby the death of an employé was occasioned, the defendants were fined £5; two other charges were not pressed and were dismissed on payment of costs.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Government Use of Beam Services.

Last week COLONEL HOWARD-BURY asked the Prime Minister whether, in view of the refusal of the Post Office to employ the Beam stations or to co-operate in any way with Imperial and International Communications for overseas telephony, he would appoint an independent committee to investigate and test the comparative efficiency of the Imperial and the American systems of wireless telephony.

Mr. MACDONALD said that the Postmaster-General had not refused to employ the Beam stations for overseas telephony. On the contrary, this matter was now under consideration by the Government and a committee of the Cabinet had been appointed to report upon it.

Wireless-telephony.

On February 4th Viscount WOLMER asked the Postmaster-General whether he intended to develop wireless-telephony by means of plant supplied by a British company or by plant supplied by an American company.

Mr. LEES-SMITH said that the practice of the Post Office in the past had been to purchase apparatus of this character on competitive tenders submitted by the only two firms in this country which were able to supply it. He had not had occasion to place an order since he assumed office, but, as at present advised, he saw no reason to depart from the practice of his predecessors.

The Electricity Commissioners.

On February 5th Mr. KELLY asked the Minister of Transport the number of Electricity Commissioners at present and what changes had taken place during the last two years.

Mr. MORRISON said that the number of Commissioners employed at the present time was five, of whom one was appointed during the past two years.

Mr. WELLOCK asked whether any Electricity Commissioners or any members of the Electricity Board were shareholders or directors of electricity undertakings, and, if so, how many.

Mr. MORRISON said that this matter was governed by statute. A Commissioner was not allowed to have, directly or indirectly, any share or interest in any undertaking for the supply of electricity otherwise than as a ratepayer in the case of an undertaking of a local authority. Somewhat similar conditions applied under the Act of 1926 to the chairman or any whole time member of the Central Electricity Board, but did not apply to members of the Board who were not whole time. He had no information as to any such holdings by members of the Board, but the Act was so framed as to allow the Board to include some members directly connected with the industry, including, of course, the publicly-owned supply undertakings.

Major NATHAN asked whether, as part of the Government unemployment plans, the work of the Electricity Commissioners had been accelerated by undertaking work additional to, or in anticipation of, the normal programme.

Mr. MORRISON said if, as he assumed, Major Nathan was referring to the new regional schemes which were being carried out by the Central Electricity Board, the answer was in the affirmative as regarded the large programme of standardisation of frequency to be carried out in connection with such schemes. The grid lines for such schemes were being constructed as rapidly as possible.

The Notting Hill Company.

On February 5th, Mr. WEST asked the Minister of Transport if he would state the cost of management per kWh, total cost, and average revenue per kWh of electricity sold in 1928 by the Poplar Borough Council and the Notting Hill Electric Lighting Co., Ltd., respectively.

Mr. MORRISON said that in view of the difference in the nature of the supplies given by the two undertakings, it was difficult to give strictly comparable figures. The cost of management at Poplar was .096d. per kWh, and at Notting Hill 0.36d. per kWh. The total cost of energy at Poplar, including capital charges, was approximately 0.83d. per kWh sold, the load factor being 31 per cent., and at Notting Hill, where the supply was purchased in bulk, 1.2d. per kW, the load factor being 24 per cent. The average revenue per unit at Poplar for lighting and domestic supplies was 2.63d. and for power 1.23d., while at Notting Hill the average for lighting and domestic supplies was 4.7d. and for power 1.52d.

Mr. WEST also inquired of the Minister if he would give the amount of profit and the rate of dividend declared by the Notting Hill Electric Lighting Co. for 1928, together with the amount paid in wages for that year.

Mr. MORRISON said that the amount of profit, after allowing for interest on loan liabilities and for statutory payments to sinking funds, was approximately £32,600. The rate of dividend on preference capital was 6 per cent. On each of the deferred shares (nominal value 1s.) the dividend was 14s. 4d. The deferred shares, however, amounted to a sum of £1,352 10s. only, out of a total share capital employed in the undertaking of £201,352, the average return on the share capital as a whole being 15.6 per cent. The amount paid in wages and salaries in the year 1928 was approximately £13,800 (wages alone £7,800), but this did not include any wages in connection with generation as energy was purchased in bulk.

L.N.E.R. Electrification.

On February 5th, Major NATHAN asked the Minister of Transport if he was yet in a position to state whether, in connection with the Government's plans for the relief of unemployment, any steps were being taken for the construction of an electric railway to Ilford and beyond, *via* Bethnal Green.

Mr. MORRISON said that the London and North Eastern Railway Co. had informed him that it had under consideration the question of the construction of a tube railway between Liverpool Street and Ilford, and was at present in communication with a well-known firm of engineers with a view to the preparation of a plan and estimates for a line of this description.

Research on Electro-deposition.

The Department of Scientific and Industrial Research, in its report for the year 1928-29, reviews the work over three years of its committee for research on electro-deposition.

The chief items of the committee's work have been: (1) the investigation of pitting and porosity in deposits of nickel, iron, and other metals; (2) the protection of aluminium against corrosion by the electro-deposition of zinc and cadmium; (3) an investigation into the fundamental aspects of the nature of adhesion and of internal stresses in electro-deposits. Work on the first item has shown that pitting, which greatly diminishes the protective value of thin deposits of nickel and affects deleteriously the mechanical strength of thicker deposits, such as are needed for building up worn or undersized parts of machinery, can be largely prevented (1) by the preliminary coating of the metal with a thickness of not less than 0.0003 inch of electro-deposited copper before the final deposition of nickel is made, and (2) by the careful control of the acidity of the solution within quite narrow limits. A number of other contributory causes have been studied.

Successful experiments have been made on a small technical scale with zinc sulphate and zinc cyanide baths; and test pieces of aluminium, protected by zinc in this manner, have been subjected to severe corrosion tests, with satisfactory results. This work has involved the detailed investigation of the effects of current density, concentration, and acidity of solutions, and of the addition to the solutions of colloids, such as gum arabic.

The internal stress in electrolytic deposits of nickel has been exhaustively studied. The existence of internal stress is liable to cause peeling of deposits from the basic metal and the main object of the research has been to find means of avoiding the production of stress during deposition. It has been shown that under suitable conditions the use of alternating current in addition to the direct depositing current leads to the formation of deposits practically devoid of internal stress.

Investigations into the deposition of silver have shown that sodium cyanide can be used with perfect success to replace the more expensive potassium cyanide in plating baths. During the course of this investigation the influence of other factors on the quality of silver deposits has been exhaustively studied.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The Electric Fittings Statutory Committee.

We have received from the Electric Fittings Statutory Committee set up by the Electricity Commissioners under Clause 48 of the Electricity (Supply) Act, 1926, its second report covering the year ended March 31st. Only two meetings were held. Owing to the serious illness of the chairman (Mr. D. N. Dunlop) the Committee was not called upon during the session for the exercise of its chief function—that of settling questions which might be raised as to "recognised" prices. Certain complaints were submitted, but no case was found to be supported by satisfactory *primâ facie* proof that the authority cited had improperly or incorrectly exercised its powers under Section 48. The Committee perfected its internal machinery during the session, so that any party desirous of presenting a complaint, on calling upon the Committee for the exercise of its statutory functions, can be assured of prompt action. Lists have been drafted of those authorities which had vested powers of sale prior to the passing of the Act, thus obviating delay in answering inquiries. During the session the Committee submitted to the Electricity Commission a report on the general run of prices of "fittings" most likely to be in demand in rural areas. The Committee also enlarged its Sub-Committee on Installation Work, as a result of which a unanimous report is about to be submitted to the Committee. The following changes in the Committee's *personnel* were made during the year:—Mr. J. A. Crabtree, representing the B.E.A.M.A. Accessories Section, instead of Mr. F. J. Collis; and Mr. A. Albrecht, representing the Electrical Wholesalers' Federation, instead of Mr. A. G. Beaver.

Committee "D" was created at a meeting of the Electricity (Supply) Act Conference, held on May 3rd, 1927, after unanimous agreement had been reached by that body on the terms of Section 48, then incorporated in the Act of 1926. The Committee was charged with the duty of reporting to that Conference on a fair-trading agreement submitted to it by the Scottish Electrical Contractors' Association. That work, in the hands of Committee "D," shortly reached the stage of agreement in principle as to the need for a common-form agreement for both countries, which naturally involved the settling of terms generally as between all classes of buyers and sellers in the trade. Committee "D" is thus working on parallel lines with the Statutory Committee.

Th members of the latter Committee are now:—Messrs. A. Albrecht, T. E. Alger, James Allan, H. H. Berry, W. F. Bishop, A. C. Cramb, G. Donovan, D. N. Dunlop (chairman), S. E. Fedden, W. Finlay, H. Marrvat, H. J. Miles. A. Nichols Moore, J. Moore, L. C. Penwill, R. W. L. Phillips, F. W. Purse, J. S. Ramsden, C. W. Sully, and F. Winstanley.

Local Exhibition.

Grassington.—An exhibition of domestic electrical appliances was held recently at the Church House, Grassington, by the Craven Hydro-Electric Supply Co., Ltd., a company generating electricity by local water power. Exhibits and demonstrations included those of the Edison Swan Electric Co., Ltd., Electrolux Co., Ltd, Hotpoint Electric Appliance Co., Ltd., Entwistle & Kenyon, Ltd., Belling & Co., Ltd., and Carron & Co.

Mr. Baldwin's Speech.

In the course of his speech last week at a meeting of the Conservative Party, Mr. Stanley Baldwin condemned the proposed "Tariff Truce," which, he said, would tie this country's hands in the matter of safeguarding its industries, a policy which was badly needed. The Dominions were endeavouring to foster their industries, other than agriculture. This was justifiable, and in the end would be to the good of the Empire. The higher wages which could be paid would mean a greater consuming power and a need for skilled immigrants which this country could supply. He was convinced that the question of unifying the British Empire lay primarily in the industrial direction. It was the Party's aim to rationalise Imperially, as well as domestically. As a first step he desired to see conferences between representatives of selected industries, such as steel, cotton and wool, in the United Kingdom, and representatives of those industries in the Dominions. Such conferences could decide which goods should be made in the Dominions and which should be supplied by this country. The questions of safeguarding and preference could be studied as well as the supply of skilled labour and research. Mr. Baldwin stressed the fact that he was opposed to any taxation of food.

New European Company Incorporated in Canada.

The incorporation of the European Electric Corporation with an authorised capital of $42,000,000 (£8,400,000) is announced from Ottawa. No reason is given for the special incorporation of this company in Canada, although it is understood that it will operate primarily in European fields. According to reports from New York the heads of the company include Count Guiseppe di Misurata, a former Italian Minister of Finance and Dr. Berth, managing director of the Swiss Bank for Electrical Enterprises of Zurich, together with representatives of the American General Electric and another American and foreign company. It is indicated that the market value of the stocks to be acquired by the corporation will exceed $26,000,000 (£5,200,000).—*Reuter* (Ottawa).

It was announced that the company would probably make a public issue this week of $12,900,000 of 6½ per cent. debentures with common stock warrants.

"Buy British Goods!"

On February 12th a meeting was to be held at the Mansion House, the Lord Mayor of London presiding, to inaugurate the National Roll of Buyers of British Goods. It is the object of the National Roll to cultivate a habit of mind which will instinctively lead to a preference for British goods. All who sign the Roll undertake to buy British products whenever possible, and it is hoped that the movement will act as a powerful stimulant to British industry.

New "Creda" Showcards.

Two showcards, which have been issued by Credenda Conduits Co., Ltd., Oldbury, Birmingham, strike an original note in publicity of this description. One illustrates a fireplace with a "Creda" imitation coal fire surmounted by an actual oval mirror over the mantel shelf. An oval piece is cut out of the card and the mirror is fitted into a slot at the back. The other card shows a lady holding a "Creda" electric iron and looking into the sole plate, which is a mirror fitted in a similar manner to the first card.

Electrical Companies' Hospital Funds.

The report presented at the 27th annual meeting of Callender's Hospital and Distress Fund on February 1st, showed that £820 had been distributed to 15 hospitals and kindred institutions, including £250 to Guy's Hospital and £105 to the Erith and District Hospital. Fourteen voluntary death levies, totalling £348, were made. During the year 630 hospital letters were issued to members and their dependants, while 185 cases of surgical and optical treatment were dealt with.

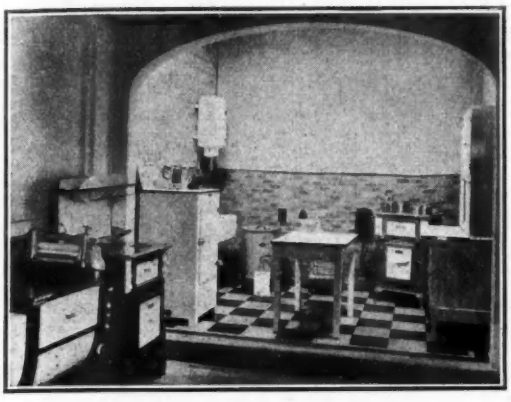
The 30th annual meeting of the Ericsson Employés' Hospital Fund was held on February 3rd, when it was reported that donations totalling £476 had been made to 18 institutions, the principal grant being £200 to the Nottingham General Hospital. It was decided to make a further appeal for the "Ericsson Bed Fund."

A Report on Cuba.

In the course of a report upon conditions in Cuba, Mr. L. C. Hughes-Hallett, Acting British Consul-General, Havana, stresses the predominance of American capital in the island. It controls many industrial enterprises, including the electric power service, and to a large extent the sale of electrical supplies. As regards radio apparatus, nearly all the receiving sets are of American make. As British radio components and appliances do not suit the standard American set Cuban dealers will not consider stocking them. A prominent Dutch electrical concern has opened its own office and showrooms in Havana and sells its own equipment complete. The report is published for the Department of Overseas Trade by the Stationery Office at 1s. 9d. net.

New Showroom at Bromley, Kent.

The Bromley Corporation Electricity Department has extended and rebuilt its old offices in West Street, Bromley, to provide adequate accommodation for the increased staff. The new building incorporates the conversion of a large and hitherto unused basement into a spacious, well lighted and comfortable showroom, with lamp and accessories stores



The Electric Kitchen at Bromley.

behind it. The new showroom was opened to the public on January 23rd, and a representative display of electric light fittings and household appliances has been staged. The walls are panelled in silvered oak and serve as an admirable setting for a well chosen selection of modern wall fittings and brackets in metalwork and tinted glassware. The showroom includes a model kitchen and scullery, which has been equipped throughout by the G.E.C. with two "Magnet" household cookers, a washer and wringer, and a 10-gal. electric storage water heater which is fitted to the tiled wall and supplies all requirements for hot water. Daily cooking demonstrations are given in the kitchen. "Magnet" cookers suitable for housholds up to six or eight persons can be hired at 11s. or 9s. per quarter and wash boilers at 4s. per quarter. A hire-purchase scheme covering various household appliances beside cookers has been adopted in order to encourage consumers, the larger proportion of whom at present utilise electricity for lighting purposes only, to consider the practical advantages of electrical appliances in the home.

Recent Contracts.

INTERNATIONAL COMBUSTION, LTD., sends us particulars of two contracts for "Wood" type steam generators recently secured by its associate, the Société Anonyme des Foyers Automatiques of Paris. The first order, for the Quaregnon power station, comprises three steam generators having an evaporation of from 190,000 to 225,000 lb. per hour at 950 lb. pressure and 840 deg. F. final temperature. The boilers will normally be fired with pulverised coal, but provision will be made for using as fuel de-hydrogenated coke oven gas. The second order is for one steam generator of a similar design evaporating from 80,000 to 90,000 lb. per hour at a pressure of 400 lb. per sq. in. and a final temperature of 800 deg. F. This unit will also be fired with pulverised fuel and is intended for the Hensies Pommeroeul Collieries.

Messrs. JAMES SCOTT & Co., Dunfermline, have installed new electrical equipment for the *Dunfermline Press*. The new plant comprises a British Thomson-Houston 30-h.p. variable speed commutator motor and a 3-h.p. barring motor with a 40 to 1 reduction for the necessary inching.

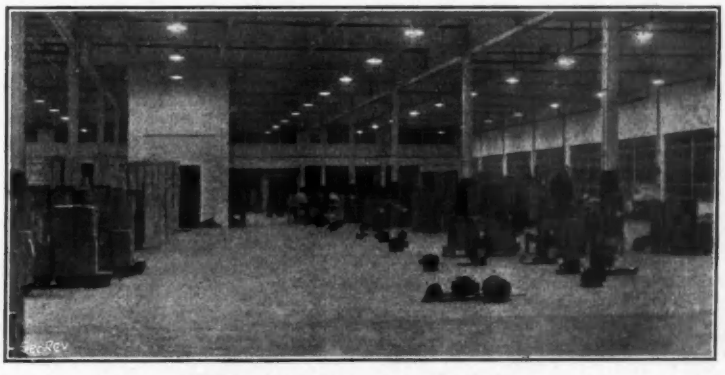
BRITISH INSULATED CABLES, LTD., has in the last few days secured a number of important contracts for electrical work. Among these is an order for the supplying and laying of 66,000-V cables for one of the large power companies operating in London. The value of this contract is in the neighbourhood of £250,000. The company has also secured the contract for the supplying and laying of the new G.P.O. trunk telephone cable from Manchester to Chester, a distance of 42 miles. Large orders have also been received for telephone cables for shipment abroad. These include 96,000 yd. of underground cable and a short length of submarine cable for Shanghai, and 20,080 yd. of underground cable for Australia. In addition, an order has been received from the Southern Railway for 40,000 rail bonds.

Included in recent overseas orders received by the BRITISH THOMSON-HOUSTON CO., LTD., is one from the High Commissioner for India (consulting engineers: Messrs. Preece, Cardew & Rider) for four large water-wheel driven alternator sets to be used in the Shanan power station of the Uhl River hydro-electric scheme. Each alternator will be driven by a Boving water wheel and will have an output of 12,000 kW, the rating being 13,333 kVA, 0.9 power factor, 11,000 V, 3 phase, 50 cycles. Each set will be provided with direct-coupled exciters arranged for automatic voltage regulation. For the supply of electric power to the mines of North Broken Hill, Ltd., Broken Hill South, Ltd., and the Zinc Corporation, Ltd., Australia, a joint power station is projected, and orders have been received by the B.T.H. Co. for six 2,500-kVA alternators and the whole of the switchgear. The alternators are of the protected type, and the stators and rotors are split on the horizontal diameter. The rotors, which are of cast iron, are designed to give sufficient flywheel effect to ensure an engine cyclic irregularity not exceeding 1/250 without the use of any additional flywheel. The stator frames are built up of fabricated construction. They will be mounted direct on the engine crankshafts, there being an outer bearing between each alternator and its overhung 110-V exciter. These outer bearings are being supplied by Sulzer Bros., Switzerland, who are manufacturing the Diesel engines. Included in the switchgear is a control board with 18 h.p. cubicles mounted beneath the switchboard gallery, the oil circuit-breakers contained in these cubicles being remote electrically operated. In addition there is a l.p. switchboard. The total number of the panels is 36 without allowing for the automatic Tirrill voltage regulator panels, which bring the total to 45. In addition to the foregoing, the company has received orders for outdoor type transformers required in connection with the electrification scheme.

The METROPOLITAN-VICKERS ELECTRICAL CO., LTD., has recently secured an order for the complete machinery and plant for the new Montevideo State electric super-power station. The order comprises two 25,000-kW, 3,000 r.p.m. turbo-generator sets, each with direct-coupled exciter and 750-kW auxiliary alternator; central flow condensing plant, with motor driven circulating and extraction pumps, and full capacity air ejectors; a 750-kW geared turbo-alternator; the necessary water-tube boiler equipment, pipe-work and valves; complete switchgear, involving 26 "K6A" and 62 "K3" electrically-operated circuit-breakers; control equipment of the double-fronted desk type, all with provision for extensions; an auxiliary service switchboard; 7,400 kW of three-phase station auxiliary transformers; accumulators and charging equipment; cable work; and automatic telephone equipment. The contract is valued at nearly three-quarters of a million pounds, and is probably one of the largest purely electrical contracts ever placed in this country for a power station overseas.

Factory Lighting Economics.

An interesting example of the benefit derived from the installation of modern industrial lighting is that recently carried out for Messrs. J. S. Fry & Sons. Careful attention was given to the subject, as it was desired to run many departments day and night and the company realised the desirability of keeping all the conditions as constant as possible throughout the twenty-four hours in order to ensure so far as was practicable the unvarying quality of their products. R.L.M. reflectors, manufactured by Benjamin Electric, Ltd., were adopted on account of their comparatively wide distribution. Although a considerable overlap was allowed by spacing the units somewhat closer together than normal for the particular mounting height, it was thought necessary still further to overcome shadows by the employment of opal lamps. In this way a very high degree of diffusion was obtained, and any possibility of glare was eliminated. The factory is of the single-floor, north-light-roof type, and both the walls and unglazed portion of the roof are painted white to give a



Lighting in Messrs. Fry's Factory

good reflector factor. The floor area to be illuminated was 38,720 sq. ft., and eighty lighting units were used, giving rather under 500 sq. ft. of area per unit, or slightly over one watt per sq. ft. As the result of a study of the economics of standard dispersive reflectors, it was calculated that the same lamps used without any reflectors would only provide an intensity of 6.5 foot candles—half the value obtained with the present installation, so that double the number of units would have been necessary to produce the required intensity. The loading would thus have been increased by 40 kW, which, if used for

1,000 hours per year, would have cost over £300 in energy at 2d. per kWh. In comparison with the £90 spent on reflectors, this shows the considerable economy effected by their use. The accompanying illustration shows a view of the installation taken at night.

The American Cooper-Hewitt Company.

The name of the Cooper-Hewitt Electric Co., of New York, has been changed to "The General Electric Vapor Lamp Co."; the trade mark "Cooper-Hewitt" will be retained. For the past ten years the Cooper-Hewitt Co. has been a subsidiary of the General Electric Co., of Schenectady, and the change in name has been made in order to co-ordinate its activities more closely with those of the American G.E.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during December last amounted to £46,835, bringing up the total for the whole of the past year to £615,690, as compared with £552,992 in 1928, an increase of just over 11 per cent.

The Timber Trade.

Our Timber Trade Correspondent reports that the consumption of housebuilding woods in the metropolis has been on very satisfactory lines during the past four weeks, and above that of the opening month of 1929. This is no doubt largely due to the cheaper prices now ruling, the keen competition in selling, and the large stocks on the market, the values of which are somewhat weak generally. The last quarter's housing contracts showed a considerable increase compared with the corresponding quarter of a year ago, and presages busier times in building directions, especially if the weather continues to be favourable for outside work. The hard and fancy woods are firm generally, but mahogany logs, with the exception of African, eased a little in values at the recent auctions. As stocks of the better quality in first hands are low, this decline, however, may be only temporary. On the other hand, teak is very firm in value. Plywood imports were immense in 1929, beating all records, and European mills are well booked up for the early months of this year.

Proposed Municipal Wiring at Bradford.

On a proposal put forward by the Labour representatives on the Bradford Electricity Committee, the city electrical engineer (Mr. T. Roles) has been asked to investigate and report on a suggestion that the wiring of electrical installations, now carried out solely by private electrical contractors, should be undertaken by the Corporation Electricity Department.

Czecho-Slovakian Electrical Imports

During December last Czecho-Slovakia imported electrical machinery and apparatus to the value of 38 million crowns, bringing up the total for the past year to 350 million crowns (£2,130,000), as compared with 265 millions (£1,600,000) in 1928.

Bankruptcy Proceedings.

G. COHEN, electrical engineer, 49, Newman Street, Oxford Street, W.—An application was made last week to Mr. Registrar Warmington at the London Bankruptcy Court for an order of discharge on behalf of this bankrupt, who failed in July, 1928. The Official Receiver reported that the provable claims amounted to £4,075, and the assets, valued at £550, had realised £344. The application was opposed by the Official Receiver on the grounds of insufficiency of assets to equal 10s. in the £ on the amount of the liabilities; omission to keep proper books of account; trading with knowledge of insolvency; a previous arrangement with creditors; and misconduct in transferring his assets in April, 1928, to an alleged partnership with his son of 17 years of age, and in appealing against the receiving order and thereby delaying the proceedings for nearly three months, whereby he was enabled to dispose of a large portion of his stock purporting to be partnership property, after the receiving order, thereby defeating and delaying his creditors and causing them substantial loss estimated by himself at £905. Further misconduct was alleged in reference to the payment of £200 after the receiving order in discharge of alleged loans. Mr. Stephen P. Child, the trustee, opposed in person, and stated that the bankrupt had most wilfully misled the Court and had spirited away the bulk of his assets during the period after June, 1928. A solicitor also opposed on behalf of the creditors, and his Honour suspended the order of discharge for five years.

J. L. GOLDSMAN, radio engineer, 100, High Holborn, and formerly, 4, Great Queen Street, Kingsway, W.C.—The first meeting of creditors was held last week at the London Bankruptcy Court. Mr. E. Parke, Official Receiver, reported that the debtor returned liabilities of £1,668 and assets of £429. He began business on his own account in January, 1929, specialising in services and repairs for manufacturers and factors. He stated that the introduction of the a.c. valve had rendered unsaleable 40 sets which he had manufactured. Being pressed by creditors and threatened with an execution he filed his petition. The failure was attributed to lack of capital, depression in trade, and heavy overhead expenses. A resolution was passed for Mr. W. A. J. Osborne, accountant, Balfour House, Finsbury Pavement, E.C., to act as trustee and administer the estate in bankruptcy.

A. JAUNDRILL, 21, Duke Street, St. Helens, Lancs., radio dealer, &c.—The public examination herein was held on February 4th at Liverpool. According to the statement of affairs there were liabilities amounting to £714, against assets of £118, leaving a deficiency of £596. In the course of the proceedings it was stated that in April last year, the debtor offered a composition of 4s. in the £ to his creditors, which was not accepted as he failed to pay the first instalment, and he continued to trade until an execution was levied on December 31st last. The Registrar stated that it was a very bad case so far as the creditors were concerned, and adjourned the examination *sine die*.

W. H. QUINTRELL, Higher East Street, St. Columb Major, Cornwall, electrical and mechanical engineer.—The public examination herein was held recently at the Town Hall, Truro. The statement of affairs showed a deficiency of £96. The debtor ascribed his failure to insufficient capital and profits. He commenced trading, it would seem, in 1926, having about £40 capital. He had become aware of his position in November, but continued to trade, hoping that the Christmas trade would improve his position. The examination was closed.

T. C. COTTRELL, electrician, 31, Autumn Street, Burley Lodge Road, Leeds.—The receiving order herein was made recently on the debtor's own petition. The first meeting of creditors was held recently at the Official Receiver's office, 24, Lower Bond Street, Leeds, when the case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate. The statement of affairs showed liabilities of £244 and assets of £117.

J. L. GOLDSMAN, radio engineer, late of 4, Great Queen Street, W.C.2.—Trustee: Mr. W. A. J. Osborne, Balfour House, 119, Finsbury Pavement, E.C., appointed February 4th.

B. H. WISHAW, electrical and wireless engineer, Bakewell Road, Matlock.—Trustee: Mr. L. A. West, Official Receiver, 22, Regent Street, Park Row, Nottingham, released, January 17th.

G. M. WILSHAW and G. SHARPE (Wilshaw & Sharpe), electrical dealers, 320, Padiham Road, Burnley.—Trustee: Mr. J. W. Carter, Official Receiver, District Bank Chambers, Blackburn, released January 23rd.

J. WESTNUTT, electrical engineer, High Street North, Dunstable.—Trustee: Mr. A. J. Rogers, Official Receiver, The Parade, Northampton, released January 17th.

B. MARSH, electrician, late of 6, Victoria Road, Brighton.—Last day for proofs for dividend, February 21st. Trustee: Mr. A. E. Orbell, 6 and 7, Old Steine, Brighton.

T. W. HALEY, plumber and electrician, 105, West Street, Leeds.—Receiving order made January 29th on debtor's own petition.

Company Liquidations.

CLAYTON & SHUTTLEWORTH, LTD.—A meeting is called for February 18th at Cannon Street Hotel, E.C.4, to authorise the appointment of Sir William McLintock as liquidator. Sir William has been acting as receiver for the last seven months and had decided to close the business down at the end of this month. Last month, however, an offer for the goodwill of the business was made by Messrs. Marshall, Sons & Co., Ltd., and it has been accepted.

DISTRICT LIGHTING SUPPLY, LTD.—A meeting of members is called for March 5th at the offices of Messrs. Wright, Fairbrother & Steel, 34 and 36, Gresham Street, E.C., to hear an account of the winding up from the liquidator, Mr. C. S. Steel.

CLEETHORPES RADIO SUPPLY LTD.—A meeting of creditors was called for February 11th at 77, Victoria Street, Grimsby, for the purpose, if thought fit, of nominating a liquidator and appointing a committee of inspection.

ELLERPHONES, LTD.—A meeting of members is called for March 6th at 51, Highgate, Kendal, to hear an account of the winding up from the liquidator, Mr. S. W. Clarke.

BATTERY PLATES.—Winding up voluntarily. Liquidator, Mr. A. Armstrong, 41, Corporation Street,, Manchester.

Private Arrangements.

L. C. HUTTON, trading as the Sports and Radio Stores, 21, Queen's Parade, Friern Barnet Road, N.11.—A meeting of creditors was held recently at the offices of Messrs. C. Latham and Co., 78, New Oxford Street, W.C. The statement of affairs showed ranking liabilities of £1,440, and net assets of £732. It was stated that nothing had been included in the assets in respect of the lease of the premises, which had nearly twenty years unexpired. The debtor also possessed a number of shares in a limited company, the value of which was unknown. The opinion was expressed that it might be possible to sell the business as a going concern. A resolution was passed confirming the deed of assignment already executed to Mr. C. Latham.

The following are creditors:—

	£		£
Gramophone Co., Ltd.	83	Dulcetto Co.	86
General Electric Co., Ltd.	44	Columbia Graphophone Co., Ltd.	22
Mullard Wireless Service Co., Ltd. ...	39	Faudels, Ltd.	46
East London Rubber Co., Ltd.	25	Dew, A. J., & Co.	371
		Philips Lamps, Ltd.	64
		James, W. H.	20

Dissolutions of Partnership.

DEVONSHIRE RADIO SERVICE, radio manufacturers, 47, Mount Pleasant, W.C.1.—Mr. L. V. Cook and Mr. P. E. Lewis-North have dissolved partnership.

C. S. MAYFIELD & Co., electrical contractors, &c., 67, Carshalton Road, Carshalton.—Mr. C. S. Mayfield and Mr. F. M. Crane have dissolved partnership. Mr. Crane will attend to debts.

For Sale.

Croydon Corporation Electricity Department has for disposal one 35,000-lb. Babcock & Wilcox boiler, complete with chain grate stokers, superheater, &c. Newbury Union has for sale a Crompton dynamo, with slate panel switchboard. Exeter City Mental Hospital Committee invite offers for two 50-h.p. steam engines, one switchboard and 30-kW dynamo. The West Central Merchandise Mart will sell by auction at York House, Southampton Row, W.C., on February 26th, a large stock of new electrical goods. Greenock Corporation Electricity Department invite tenders for the purchase and removal of two 500-kW rotary-convertors and one 750-kW rotary-convertor. The Irish Free State Electricity Supply Board has for disposal one 3-phase, 1,400-kW generator, one 3-phase, 1,500-kW generator, one 2,200-h.p. Parsons steam turbine, and one Belliss & Morcom 2,200-h.p. steam engine. (See our advertisement pages to-day.)

New Catalogues and Lists.

Messrs. GOODALL, CLAYTON & Co., LTD., Pepper Road, Hunslet, Leeds.—A well-produced and illustrated brochure dealing with conveying plant showing actual installations carried out by the company.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—A loose-leaf catalogue containing illustrated particulars of "Metalix" tubes for radiography.

SIEMENS BROS. & Co., LTD., Woolwich, S.E.18.—Catalogue No. 170, dealing with jointing materials, and a list containing prices of these materials.

Messrs. EVERSHED & VIGNOLES, LTD., Acton Lane Works, Chiswick, W.4.—The new issue of the Midworth distant repeater catalogue (No. D-162) has been completely re-written and considerably enlarged. It contains a very full description of this repeater with some excellent illustrations.

RELAY AUTOMATIC TELEPHONE Co., LTD., Marconi House, Strand, W.C.2.—A leaflet drawing attention to the company's automatic private telephone system.

Messrs. YOUNG & WILDSMITH, 35, Little Russell Street, New Oxford Street, W.C.1.—An illustrated pamphlet containing prices and dimensions of American moulded glassware.

Calendar blotters for February have been received from Messrs. DE BRUNNER & LANG-SIMS, 3 and 4, King Street, Covent Garden, W.C.2, S. ROGERS & Co., LTD., 15, Fitzroy Street, Tottenham Court Road, W.1, MAVOR & COULSON, LTD., 47, Broad Street, Glasgow, S.E., and POPE'S ELECTRIC LAMP Co., LTD., 5, Arthur Street, New Oxford Street, W.C.2.

Messrs. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—An illustrated leaflet describing the company's oil-immersed rotor starters.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—A stock list of a.c. and d.c. motors, transformers, &c.

Book Notices.

"Markets of Empire," by W. H. Wilson. Pp. xv+280. London: Effingham Wilson. Price 7s. 6d. This book is composed of articles reprinted from *The Times Trade and Engineering Supplement*, and it is prefaced by a detailed list of official trade representatives in the Dominions and Colonies. Australia, Canada, India, New Zealand and South Africa are treated separately at some length while other British Possessions and Protectorates are covered in an "omnibus" section. In each case the principal import lines are examined and notes on the market are given. In the principal sections there are special chapters on electrical and radio equipment. The treatment, however, is necessarily very brief and occasionally superficial. So far as Australia is concerned, the recent tariff amendments have somewhat modified the position presented by the author.

"Mechanical World Electrical Pocket Book, 1930." Pp. 387; fully illustrated. Manchester: Emmott & Co., Ltd. Price 1s. 6d. net. The usual high standard of this work has been maintained. All the former sections have been retained, and those on Lighting Circuits and Switching have been entirely revised, and those on Lamps and Lighting have been re-written and brought up-to-date. Some new matter is to be found in the section of Heavy Electrical Engineering.

"Collected Researches of the National Physical Laboratory." Vol. XXI, 1929. H.M. Stationery Office. Price 22s. 6d.

"Commercial A.C. Measurements," by G. W. Stubbings. Pp. xvi+325; figs. 169. London: Chapman & Hall, Ltd. Price 15s. net.

"Motorists' Electrical Guide," by A. H. Avery. Pp. vii+162; figs. 133. London: Sir Isaac Pitman & Sons, Ltd. Price 3s. 6d. net.

"Science Abstracts" (A. & B.), Vol. XXXIII. January, 1930. No. 385, and Indexes A. & B. for Vol. XXXII, 1929. London: E. & F. N. Spon, Ltd. Price 3s. each.

"Electrical Wiring and Contracting" by H. Marryat. Vol. II. Pp. viii+512; figs. 17. London: Sir Isaac Pitman and Sons, Ltd. Price: 6s. net.

"Principles of Radio," by K. Henney. Pp. xii+447; figs. 305. London: Chapman & Hall, Ltd. Price 17s 6d. net.

"Television." Mr. H. Horton Sheldon and Mr. E. N. Grisewood. Pp. iv+194; figs. 127. London: The Library Press, Ltd. Price 10s. 6d.

E.D.A. Activities.

At a meeting of the North Midland Section of the British Electrical Development Association, held at Leeds Corporation Electricity Department offices on February 4th, Mr. C. F. Wells, sales engineer to the Electrical Distribution of Yorkshire, Ltd., gave an address on "Domestic Electrification with Special Reference to the E.D.A. Electric Homes (Outlet) Campaign," in which he referred to the success of the Association's "W.O.B." campaign. He said that many households were still prevented from using more apparatus because of the scarcity of plug points, and the present inadequacy of domestic wiring represented an enormous loss of business to the country. Referring to the E.D.A. Home Wiring Specification, he said it was designed to ensure an adequate and convenient supply of electricity for all domestic purposes, and he recommended it as the standard for all new houses.

An Electrical Carnival organised by the North-East Area Committee is being held at the Oxford Galleries, Newcastle, this (Friday) evening. There will be dancing from 8 p.m. to 2 a.m.

Unemployment.

There was an increase of 18,098 in the number of registered unemployed during the week ended January 27th. At that date the total was 1,491,500, as against 1,473,402 on January 20th, and 1,394,078 on January 28th, 1929.

The Spanish Battery Market.

A confidential report on the market for accumulators and primary batteries in Spain has been prepared by the Department of Overseas Trade from information furnished by the Commercial Secretary, Madrid, and issued to firms whose names are entered on its Special Register. United Kingdom firms desirous of receiving a copy of the report, together with particulars of the Special Register service of information, should communicate with the Department at 35, Old Queen Street, S.W.1. Reference number B.X. 6085 should be quoted.

The Bristol Electric Club.

The annual general meeting of the Bristol Electric Club was held January 31st. The president, Mr. A. H. Dowson, was in the chair, and reports were received from the treasurer and secretary, which gave a very satisfactory statement of the Club's progress. The following officers were elected for the coming year:—President, Mr. A. H. Dowson; chairman, Mr. W. L. Richards; hon. treasurer, Mr. A. C. Baker; and hon secretary, Mr. F. R. Ashmead. The members of the committee are Messrs. Nichol, Rogers, Denman, Walker, Wallis, Porter, Skinner, Cutler, Hodge, Lovell, Murphy, and E. A. Davies.

A vote of thanks was accorded to Mr. J. S. Mitchell, the retiring secretary, and the meeting concluded with a musical programme. The new secretary's address is, 75, Victoria Street, Bristol.

Trade Announcements.

Messrs. OERLIKON, LTD., are removing on February 17th to better-situated offices at Victoria House, Southampton Row, W.C.1. (Telephone: Holborn 0824-5; telegrams: "Oerlik, Westcent, London.")

The KENT ELECTRIC POWER Co. has opened offices and showrooms at 110, High Street, Sittingbourne, to which district a supply of electricity has just been commenced.

On February 10th the Liverpool branch of the BRITISH THOMSON-HOUSTON Co., LTD., was transferred to 27-29, Stanley Street. The telephone number (Bank 7500) and the telegraphic address ("Asteroidal, Liverpool") are unchanged.

Owing to the expiration of lease, Messrs. DRAKE & GORHAM WHOLESALE, LTD., have changed their address from 67, Long Acre, to 77, Long Acre, W.C. The telephone number is Temple Bar 3993, and the telegraphic address remains the same.

Messrs. SHROSBERY, BAKEWELL & Co., LTD., electrical contractors, 69, Crouch Street, Colchester, have opened new showrooms for the radio department at 73, Crouch Street.

The offices of Messrs. WILLIAM G. THOMAS, LTD., have been removed to 4, Fairfield South, Kingston-on-Thames.

Mr. F. S. DINENAGE (for 18 years associated with the Edison Swan Electric Co., Ltd., in the Midlands) has commenced business on his own account at 43, Church Street, Birmingham (Telephone: Central 6888), as electrical and manufacturers' representative. He asks for manufacturers' catalogues.

Mr. F. E. BAKER, of 40, Broxholm Road, West Norwood, S.E.27, has joined Mr. T. A. Rose, 25, Milton Street, E.C.2, as representative for the South Coast.

Registered Electrical Contractors.

Applications for registration from the following were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Hulton & Hinchliffe, Ltd., Oldham.
Brandrick, J., Royton.
Ward & Co. (Dewsbury), Ltd., Dewsbury.
Calligan, T., Greenfield, near Oldham.
Hutt, W. G., London, W.5.
Cooper & Sellers, Wellingborough.

Barnsley Corporation Electricity Department.
Rigby & Partners, Ltd., Westminster, S.W.1.
Farrar, M. F., Halifax.
Kettering U.D.C. Electricity Department.

At the same meeting two applications were declined and two were withdrawn.

Prices of Raw Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, February 11th: No change in copper and rubber prices.

Messrs. Edward Till & Co., report February 11th: India rubber, Para fine, 7¾d. ¼d. dec.

Messrs. James Forster & Co., reporting on February 8th, stated that the lead market was continuing to fluctuate within narrow limits at slightly under the Association's price. Speculation is almost entirely absent, which is not to be wondered at considering the want of confidence in the position. Demand everywhere remains exceedingly quiet with a declining consumption. Stocks, meanwhile, in producers' hands are growing rapidly, and this state of affairs seems likely to continue so long as the price is held at an uneconomic level.

Lighting and Power Notes.

Aberdeen.—SUB-STATION EXTENSIONS.—The Town Council has approved the expenditure of the following sums on extensions to sub-stations: King Street sub-station, £845; Rubislaw sub-station, £4,831; Northern Co-operative Society's private sub-station, £275; and the private sub-station of the Mutual Fish Products, Co., Ltd., £830. The cable extensions at King Street, Berryden Road and Pointlaw will cost £5,838.

Ashford (Kent).—NEW PLANT.—The Urban District Council has received sanction to install another 800-kW set at the electricity works.

Australia.—VICTORIA.—The report of the State Electricity Commission for the year ended June 30th last, shows a total revenue of £1,427,751, as compared with £1,262,785 in the preceding year. Expenditure, including interest on loans, depreciation and contribution to sinking fund, totalled £1,382,174, as against £1,229,064, leaving a net profit of £45,577 (£33,721). The total quantity of energy sold increased from 319,282,728 to 358,089,467 kWh, while the maximum demand on the Yallourn, Newport B, Richmond and Sugarloaf-Rubicon stations totalled 113,610 kW. Extensions now in hand include the installation of an additional 50,000-kW of generating plant at the Yallourn station, the completion of a ring-main for supplying the north-central and north-western districts of Victoria, including Bendigo and Ballarat, the construction of a new 132,000-V transmission line between Yallourn and Melbourne and the erection of a new terminal station at Richmond.

Aysgarth.—TRANSFER OF UNDERTAKING.—Messrs. W. H. Burton & Sons, of Askrigg, have acquired the Aysgarth electricity undertaking and will install a complete new plant in time for use next winter. The charges will be slightly lower than hitherto, and will probably be about 9d. per kWh.

Bath.—LOAN SANCTIONED.—The City Council has received sanction to the borrowing of £2,000 for sub-station equipment.

Birkenhead.—CHANGE-OVER.—The Corporation Electricity Committee has decided to proceed in stages over a period of year, at a cost of £10,100, with the work of substituting a.c. for the existing d.c. supply in Grange Road, Cavendish Drive and Bebington Road.

Blackburn.—LOAN.—The Corporation Electricity Committee recommends that sanction be obtained to the borrowing of £20,000 for mains and services.

Bridlington.—LOANS.—The Town Council has applied for sanction to loans of £3,000 for mains and £1,000 for services.

ELECTRICITY SUPPLY.—The Electricity Commissioners are to be approached with a view to the parishes of Flamborough, Sewerby-cum-Marton, Bempton, Buckton, Grindale, Easton, Boynton, Bessingby, Carnaby, Fraisthorpe-with-Auburn, and Wilsthorpe being eliminated from the Draft Order of the Holderness Trust, Ltd., and included in a Special Order to be applied for by the Corporation.

REVISED TARIFFS.—The charges for electricity for cooking and heating are to be as follows as from December 31st last: If a cooker of 4-kW capacity or over is installed, all energy for domestic purposes, including heating but not lighting, to be charged at 1d. per kWh. If the cooker is less than 4-kW capacity, all energy for domestic purposes, excepting heating and lighting, to be 1d. per kWh.

Burton-on-Trent.—NEW SWITCHGEAR.—The Corporation Electricity Committee has authorised work in connection with the main switchboard and switchgear required at the electricity works when the generating station is connected to the grid. The estimated cost of the work will be £30,346, made up as follows:—£5,821 for the rearrangement of existing board; £19,625 for new switchgear and house; and £4,900 for transformers.

Bury.—MAINS EXTENSIONS.—The Electricity Committee is to lay additional feeders in different parts of the borough at a cost of £8,000.

Chesterfield.—ALTERNATIVE DOMESTIC TARIFF.—The Corporation Electricity Committee recommends the adoption of the following alternative tariff for electricity for domestic purposes:—17½ per cent. of ratable value per annum, plus ¾d. per kWh consumed.

Colchester.—MAINS EXTENSIONS.—The Corporation Electricity Committee has decided to carry out extensions at Stanway and Chitts Hill, at an estimated cost of £570 and £250, respectively. The Committee has also decided to complete the inner ring main at a cost of £853.

Continental.—ANDORRA.—A Spanish industrialist has offered to build a motor-road from Encamp to Soldeu in exchange for the right to exploit the country's water-power resources. It is reported that this offer has been accepted and that the new road will be built this year. A party of French surveyors has arrived at Les Escaldes to survey the road and select a site for the erection of power plant.—*Reuter's Trade Service* (Barcelona).

RUSSIA.—Four 100,000-h.p. hydro-electric generators are now being manufactured at the Schenectady Works of the American G.E. for the Dnieper River water-power development at Kichkas, near Zaporozhe, in the Ukraine. This plant, when completed, will supply power in the vicinity of Dnepropetrovsk and to the southern part of the U.S.S.R. The total weight of each generator will be about 1,760,000 lb., while the weight of the rotor and shaft will be nearly 980,000 lb. The maximum diameter is about 42 ft., and the generators will have an overall height of 40 ft., 5 in., of which 17½ ft. will extend above the floor of the plant. Large castings have been eliminated by the use of fabricated welded construction.—*Reuter's Trade Service* (New York).

CORSICA.—La Compagnie Réunies de Gaz et d'Electricité has recently secured the concession for the supply of electricity to 127 villages and small towns in the north and north-west of Corsica.

FRANCE.— La Société d'Etudes de la Valserine, of Paris, has recently secured a concession to establish a hydro-electric station at Lelex, in the Department of Ain, to utilise the power of several falls on the River Valserine. It is estimated that 31,500 kW is available.

Darwen.—CHANGE-OVER.—Application is being made to the Electricity Commissioners by the Corporation for permission to change the system of supply from d.c. to a.c. Sanction is being sought to the borrowing of £22,000 for that purpose and for the renewal and extension of mains.

Glasgow.—MAINS EXTENSIONS.—The Corporation Electricity Committee recommends the extension of distribution mains at a cost of £8,099. It also recommends the completion of a h.p. ring main within the Dawsholm Gas Works, at a cost of £1,000.

HOSPITAL SUPPLY.—The Corporation Health Committee is to arrange with the Electricity Committee for the renewal of the power and lighting cable at Ruchill Hospital, at an approximate cost of £2,500, and to confer with the department as to the arrangements which require to be made in connection with a proposed change-over from d.c. to a.c.

POWER STATION FUMES.—At a recent meeting of the Electricity Committee the Town Clerk reported that a conference of owners of base-load stations was held in London at which the Corporation was represented. At this conference it was resolved that a small committee of eight be appointed to investigate the question of chimney emissions and the removal of nuisance arising therefrom, and that one of the said representatives be nominated by the Scottish owners of selected stations. The Committee authorised the Town Clerk to call a meeting of representatives of Scottish owners of selected stations for the purpose of nominating a representative and to appoint the Convener and the manager to attend the meeting.

Honiton.—ELECTRICITY SUPPLY.—At a recent meeting of the Town Council it was stated that the East Devon Electricity Co., Ltd., had entered into an agreement with the Exeter Corporation for a supply of electricity in bulk for distribution throughout Devon and part of Somerset. The cost of laying new mains in Honiton would be approximately £10,000. The Council decided to offer no opposition to the scheme.

Isle of Wight.—SUPPLY AGREEMENT REFUSED.—The Rural District Council has declined to enter into an agreement with the Isle of Wight Electric Light & Power Co., Ltd., in connection with a proposed new scheme of supply. The proposed agreement fixed the charge for lighting at 8d. per kWh when the change to a.c. took place, and 2d. per kWh for power and heating. The company had agreed to the period of monopoly under the scheme being reduced from 50 to 38 years.

PROPOSED CHANGE-OVER.—At a recent meeting of the Newport Lighting Committee a letter was received from the Isle of Wight Electric Light and Power Co., Ltd., applying for consent to change the system from d.c. to a.c., and stating that the cost of the alteration or replacement of, apparatus on consumers' premises rendered necessary by the change would be borne by the company. The Committee recommended that consent be given.

Keighley.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £40,000 for mains and services.

Liverpool.—POWER STATION EXTENSIONS.—The Clarence Dock Special Committee of the City Council has decided to make application to the Electricity Commissioners for their consent to the extension of the Clarence Dock power station by the installation of a second 50,000-kW turbo-alternator together with the requisite switchgear and auxiliary plant, at an estimated cost of £206,170. The City Council is also applying for sanction to the borrowing of £32,388 for buildings and plant at the Lister Drive power station, and £3,344 for main transmission lines.

London.—SOUTHWARK.—The Borough Council Electricity Committee recommends that the minimum charge per quarter for electricity supplied should be reduced from 10s. to 5s. during the summer quarters. With regard to the large power consumers the Committee recommends that all energy consumed above 25,000 kWh per quarter should be charged at ¼d. per kWh.

BERMONDSEY.—The Borough Council Electricity Committee reports that it will be necessary to lay two new feeder cables, one to a position near Rothesay Street and the other to a position near Crucifix Lane and White's Grounds, at a cost of approximately £6,000.

BATTERSEA.—The London County Council has consented to a proposal of the Borough Council to substitute an a.c. distribution system at 50 cycles, 230-V, single-phase and 400-V three-phase in that part of the borough in which a d.c. supply is in force.

CHELSEA.—The London County Council has consented to a proposal of the Chelsea Electricity Supply Co., Ltd., to change its system and pressure of supply from d.c. at 200/400 V to a.c. at 230/400 V.

WANDSWORTH.—The Electricity Consumers' Committee has received a communication from the secretary of the County of London Electric Supply Co., Ltd., stating that, pending a decision regarding the recalibration of meters, rebate will be made to slot-meter consumers when collections are made.

Manchester.—STREET LIGHTING.—Contrary to a recommendation of the Lighting Committee the City Council has decided to light Queen's Road between Cheetham Hill Road and Oldham Road by electricity instead of gas.

North Berwick.—REVISION OF ELECTRICITY TARIFFS.—The Burgh Electricity Department announces that as from the quarter beginning April 1st the charge of 2s. 6d. for the rent of meters will be abolished. An alternative two-part tariff is also to be introduced, the fixed charge being based on £13 per kW of adequate lighting. The running charge will be 1½d. per kWh.

Northern Ireland.—CARRICKFERGUS, CO. ANTRIM.—At a recent meeting of the Urban District Council an electricity scheme estimated to cost £25 000 was considered, and it was decided to apply to the Electricity Commissioners for a Special Order authorising the Council to supply electricity in the district. It was stated that Ballynure was also desirous of obtaining an electricity supply and it was suggested that the Council should take over that area.

Plymouth.—MAINS EXTENSIONS.—The City Electricity Committee has approved mains extensions in various parts of the city at an estimated cost of £9,000.

Rothesay. — EXTENSION SCHEMES. — The Corporation's schemes for the extension of the electricity supply by underground cables to the Craigmore and Barone Road districts have been approved by the Unemployment Grants Committee.

Special Orders.—The Spenborough Urban District Council and Electrical Distribution of Yorkshire, Ltd., have applied to the Electricity Commissioners for a Special Order authorising the Council to extend its area of supply under the Cleckheaton Electric Lighting Order, 1900, so as to include part of the town of Liversedge in the Spenborough urban district, and authorising the company to extend its area of supply under the Liversedge Electric Lighting Order, 1907, so as to include a part of the town of Cleckheaton in the Spenborough urban district.

The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the King's Lynn Corporation to supply electricity in the rural district of King's Lynn and part of the rural district of Freebridge Lynn.

Stirling.—ELECTRICITY SUPPLY.—With reference to the Scottish Central Electric Power Co.'s proposal to obtain authority to construct sub-stations, transforming stations, and other works under public streets, the Corporation Electricity Committee has decided to ask the company to modify its scheme.

Torquay.—OVERHEAD LINE.—The Corporation Electricity Committee is to apply for sanction to the borrowing of £2,010 for the erection of an overhead line from Buckfastleigh to Ashburton for the purpose of giving a supply of electricity to the latter town.

Tunbridge Wells.—BULK SUPPLY REFUSED.—It was reported at a recent meeting of the Town Council that the Lighting Committee had been unable to entertain a proposal to give bulk supply of electricity to the East Grinstead Urban District Council.

Walsall.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee recommends an expenditure of £15,500 on mains, sub-station equipment, and buildings. Mains are to be extended in Little Bloxwich at a cost of £640.

Wimbledon.—NEW SUB-STATIONS.—The Corporation Electricity Committee recommends the provision of five new sub-stations and two new transformer kiosks, the enlargement of 18 existing sub-stations, and the equipment of several sub-stations on consumers' premises at a total estimated cost of £19,000.

REPLACEMENT OF CABLES.—The Committee recommends the laying of supplemental cables and the replacement of one of the e.h.p. mains between Raynes Park and Malden sub-stations, and a similar main from the electricity works to Raynes Park sub-station, by cables of a larger section, at a total estimated cost of £22,196.

POWER STATION EXTENSIONS.—The Committee is applying for sanction to the extension of the plant at the generating station by the addition thereto of a 7,500-kW, two-phase, turbo-alternator with switchgear and auxiliaries, and for sanction to the raising of a loan of £33,000 for the purpose.

STREET LIGHTING CHARGES REDUCED.—The Committee has reduced the charge for street lighting in the borough from 1¼d. to 1¼d. per kWh as from April 1st next.

Worcester.—SUPPLY EXTENSION SCHEME.—The City Council has agreed to the spending of £100,000 during the next four years on the laying of mains in 240 streets and considerably extending the mains in the area outside the city which is served by the local undertaking.

York.—LOAN.—The Town Council has applied for sanction to a loan of £7,650 for h.p. switchgear required in connection with the Mid-East England Electricity Scheme.

Tramway and Railway Notes.

Australia.—MELBOURNE.—The Victorian Legislative Assembly has passed a Bill extending the appointment of the Melbourne and Metropolitan Tramways Board for a further period of twelve months and granting an increase of £750,000 in its borrowing powers. This sum is to be spent on the conversion of the North Fitzroy and South Melbourne cable tramways to electric traction, the duplication of certain tracks and the purchasing of new equipment.

Birkenhead.—TRAMCAR RECONDITIONING.—The Corporation Tramways Committee has decided that ten additional tramcars shall be refitted at an estimated cost of £2,000.

Continental.—SWITZERLAND.—It is reported that the Brown-Boveri Co., of Baden, in conjunction with the Swiss Locomotive and Engineering Co., of Winterthur, has recently completed a new type of express electric locomotive for use on the St. Gothard section of the Swiss Federal Railways. The engine consists of two closely-coupled halves, each of which has two pairs of motor-driven axles between three running wheel axles. The complete engine, which is stated to weigh 230 tons has 14 axles and 28 wheels. It has been designed for a maximum speed of 62½ m.p.h. and a normal speed of 41½ m.p.h.

FRANCE.—*New Electric Locomotives.*—The first of the four electric locomotives, known as the 262 A.E. type, which have been order by the Cie. Paris-Lyons-Méditerranée has been put into service. According to the *Révue Générale des Chemins de Fer* (December), these machines are said to be the most powerful in the world, as each locomotive consists of a single frame. The principal girders of the frame are 17.7 m. long, placed 1.82 m. apart, and the total length of the locomotive over the buffers is 23.8 m. The total weight in running order is 159 tons. The wheel arrangement is 2-6-2, ten axles. The six motor-driven axles are placed on two bogies and have wheels 1.6 m. in diameter, and the wheels of the leading and trailing bogies are 1.01 m. The driving wheels are operated by twin six-pole motors at 1,500 V, and each pair of motors develops 695 h.p. continuously and 890 h.p. at the one-hour rating, at the tire of the driving wheel. They give a speed of 87 and 80 km. per hour, at 826 and 758 r.p.m. At 100 km. the motors work at 1,053 r.p.m., and at the extreme limit of 130 km. at 1,369 r.p.m. The total weight of each twin motor is 5,540 kg. The maximum power of the locomotive is thus 4,170 h.p. continuously, or 5,340 h.p. at the one-hour rating. It is capable of hauling an 800-ton train at 90 km. with occasional gradients of 0.8 per cent., and at 100-110 km. entirely on the level. The mechanical construction has been carried out by the Société de Construction des Batignolles and the Cie. Générale de Construction de Locomotives. The electrical apparatus has been made in France by the Société Oerlikon.

Lancashire.—NEW JOINT TRAMWAY SERVICE.—Arrangements have been made between the Salford Corporation and the Lancashire United Transport & Power Co., Ltd., for the running of a joint tramway service between Manchester and Farnworth.

London.—UNDERGROUND EXTENSIONS.—At special meetings held recently of the Metropolitan District Railway Co., London Electric Railway Co., City and South London Railway Co., and Central London Railway Co., approval was given to Bills now before Parliament empowering the companies to carry out certain new works and improvements. The total estimated cost of the whole scheme of works for which powers were sought in the Bills was approximately £12,000,000, of which extensions would account for £8,000,000. It was considered that this would involve the raising of an additional £13,500,000 of capital.

New Zealand.—CHRISTCHURCH.—According to a report issued by the Tramways Board on the working of the tramway undertaking for the year ended March 31st last, the total revenue was £276,689, as compared with £285,117 in the preceding year. Working expenses decreased from £205,368 to £196,522, leaving a gross profit of £80,167, as against £79,749. After providing for capital and other charges there was a net surplus of £7,746, as compared with a net deficiency of £5,650 in 1927-28. The number of passengers carried decreased from 24,695,645 to 24,088,063, and the tram mileage from 2,666,477 to 2,595,853. The revenue per car mile rose from 19.299d. to 19.357d.

Wallasey.—PROPOSED TRAMWAY ABANDONMENT.—A scheme is being prepared by the Corporation Tramways Committee for the substitution of 'buses or railless cars for the tramway system.

Walthamstow.—TRACK RECONSTRUCTION.—The Urban District Council has applied to the Ministry of Transport for sanction to the borrowing of £7,600 for the doubling of the track in Woodford Road, and £2,325 for the construction of a new track in the tramway depôt.

Telegraph and Telephone Notes.

France.—TELEPHONE OPERATORS.—In order to reduce the time necessary for making connections for subscribers, the Post and Telegraph Authorities are increasing the number of exchange operators, so reducing the number of connections to which each operator has to attend. Thus at the Boulogne (Paris) exchange the number of subscribers per operator is being reduced from 260 to 200; at Montreuil-sur-Bois from 240 to 180; at Vincennes from 320 to 240 and later to 200; and at Levallois from 200 to 180.

International Telephony.—GERMAN CABLES.—It is reported that the Siemens & Halske Co., of Berlin, has secured the contract, under the war reparations agreement, for the new telephone cable which is to be laid between Boulogne (France) and Seabrook, near Folkestone (England).

The marine telephone cable which a well-known Cologne cable concern is to construct and lay between Stralsund (Pomerania) and Malmo (Sweden) will contain 170 lines, making it possible for 84 conversations to be carried on simultaneously. It is claimed that this will be the largest number of speaking circuits contained in a single marine cable. The new cable will be the fourth between the towns mentioned, the series representing noteworthy advances in construction: the first cable, laid in 1919, contains only two speaking circuits; in the second, laid two years later, the circuits were increased to six, while in the third, laid in 1927, the number was increased to twelve.—*Reuter's.*

The Telephone Service.—PROGRESS IN LANCASHIRE.—The annual reports of the Postal, Telegraph and Telephone Advisory Committee of the South Lancashire district (superintending engineer: Mr. W. J. Medlyn, M.I.E.E.) are indicative of the growth of the service in the under-mentioned areas during the year ended December 31st, 1929.

MANCHESTER.—The number of telephones increased from 87,390 to 91,968; the number of new ones fitted was 9,436, and the cessations 4,858. There has been a growth of 175 per cent. in 17 years. Since July, 1929, the minimum rental has covered a radial distance of two miles from an exchange, instead of 1½ miles, which represent a reduction of £2 per annum for subscribers over 1½ miles from an exchange. The effective trunk calls and telegrams totalled 6,685,426, an increase of 203,292, and local calls numbered 70,250,000, against 66,000,000 in 1928. The average speed of answer was 5.9 seconds, against 5.8 seconds last year. The prime cost value of telephone-line plant, apparatus, and buildings provided for in the Manchester district was about £7,100,000, of which sum about £1,700,000 has been redeemed under the sinking fund allowances. Extensions of existing equipment have been carried out at many exchanges. An addition of 124 street kiosks was made to the 1928 total of 386, making a total of 510. Under the budget proposal 28 rural call offices were completed at post offices and railway stations within a radius of two miles from the exchange. The provision of 10 similar call offices situated over two miles from the exchange is under consideration. The demand for Continental service at Manchester increased by 69 per cent.

LIVERPOOL.—The number of new telephones fitted was 7,259, the net increase being 3,215, which was not quite so satisfactory as in the previous year, and was due partly to the removal of businesses from Liverpool to London. The number of telephones increased to 72,644, a growth of 108 per cent. in 17 years. Traffic between Liverpool and the Continent slightly decreased during the past year, chiefly in the case of Germany. A telephone cable to the Isle of Man and the north of Ireland was successfully brought into full active service during the past year. Two direct circuits between Liverpool and Douglas were provided initially, and an average of 102 calls per day was dealt with during the season. An additional circuit has since been provided between Douglas and Manchester and two circuits between Liverpool and Belfast. The speech transmission is remarkably good. The number of calls dealt with in the district numbered 70¼ millions, an increase of about 3½ per cent. The number of phonograms dealt with amounted to 300,000, an increase of about 5 per cent. The provision of street call kiosks is still being extended, but mainly outside the City of Liverpool; in Liverpool itself development has been retarded, owing to some reluctance on the part of the city authorities to consent to the erection of kiosks on the highways. About 30 rural call offices have already been opened in this district.

DUDLEY AUTOMATIC AREA.—On February 8th some 2,190 subscribers in the Dudley telephone area, which includes the four exchanges at Dudley, Brierley Hill, Cradley Heath, and Stourbridge, were changed over from the manual to the automatic system.

U.S.A.—POLICE TELEPHONES.—The State of Pennsylvania, with an area only slightly smaller than England's, has established over the whole of its territory a complete network of police telephones, which links no fewer than ninety-five towns and cities and one-hundred local authorities; the telephone circuit length is over 3,400 miles. The central headquarters of the system are at Harrisburg, and there are zone headquarters at Philadelphia, Pittsburg, and Wyoming. For transmitting messages from the various headquarters a telephone typewriter is used, which instrument is a development of the writing telephone invented many years ago, but never brought into general use. It types simultaneously on a special pad in each local station the message sent from headquarters.

Radio Notes.

Australia.—TRANSMITTING LICENCES.—The broadcasting companies have made a claim for compensation by the Federal Government owing to the latter's failure to renew their licences, which they allege the late Government definitely promised to renew.

Mr. Bruce, however, has denied that he made any such promise. He never went further than to say that if the amalgamation of the companies was arranged in a way satisfactory to the Government, favourable consideration would be given to the renewal of the licences.

Germany.—NEW STATIONS.—The Post Office authorities have decided to erect a new high-power transmitter at Heilsberg, East Prussia, with a power of from 60 to 100 kW, and two aerial masts 325 ft. high made of wood lattice. The studio will remain at Königsberg, 40 miles away. The fate of the present Königsberg transmitter has not been settled, but *World-Radio* expects the new one to be ready in October next.

The new transmitter at Leipzig and the stand-by plant at Berlin-Witzleben are nearing completion.

Japan.—RADIO BEAM TELEPHONY.—Mr. Reijiro Wakatsuki, the chief Japanese delegate to the London Naval Conference, spoke to the people of Japan on Sunday afternoon by Marconi beam telephony from the station of Imperial and International Communications, Ltd., at Dorchester, England, his speech being relayed throughout Japan by means of the Japanese Broadcasting Company's stations. Wireless telephony apparatus was connected to the beam aerial used for telegraphy with Japan, the signals being clear and loud. At the conclusion of the speech, from 3 o'clock till 3.30, a number of gramophone records were transmitted to Japan for re-broadcasting. Re-broadcasting was successful from the Tokio, Osaka, Nagoya, Hiroshima, Kumamoto, Sendai, and other stations.

Licences.—LIVERPOOL.—In the Liverpool telephone area during 1929 the number of receiving issued increased by more than 6,000 over the number issued during 1928. There were six prosecutions in the district during the year for the use of receiving apparatus without licences, and in each case a conviction was secured.

U.S.A.—TEN MILLION HOMES USE WIRELESS SETS.—In 1922 some 60,000 American homes were equipped with wireless receiving sets; to-day at least 10,000,000 homes have them. These remarkable figures were revealed by Mr. W. D. Terrell, chief of the radio division of the Department of Commerce, during the committee stage of the Department's annual supply bill. The wireless audience in 1922 was estimated at 75,000, while this year it had attained 40,000,000. The total radio sales value, covering mostly receiving sets and accessories, for the fiscal year 1922 amounted to 60,000,000 dollars (£12,000,000) Mr. Terrell added, while in 1928 the figures were 650,500,000 dollars (£130,110,000). It was estimated that only 19,000 homes were without radio sets. The Radio Manufacturers' Association states that, although radio products worth 2,500,000,000 dollars have been manufactured since 1922, there is no saturation point in sight.—*Reuter's* (Washington).

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Ashford.—February 28th. Urban District Council. Erection of 900-kW vertical solid-injection heavy oil engine with alternator at the electricity works. (See this issue.)

Australia.—MELBOURNE.—Posts and Telegraph Department. February 25th. Primary battery material. (B.X. 6139.)*
March 11th. Bells and buzzers. (B.X. 6053.)*
March 24th. Dial parts. (B.X. 6047.)* Automatic exchange power boards. (B.X. 6072.)*
March 25th. Cordless switchboards. (B.X. 6071.)*
April 1st. Submarine cable. (B.X. 6070.)*
April 15th. Cord type switchboards. (B.X. 6135.)*
March 10th. State Electricity Commission of Victoria. Two 6,000-kVA, 3-phase transformers with spare coils and bushings. (B.X. 6014.)*

Bedford.—March 10th. Electricity Department. Supplies during the year ending March 31st, 1931, of e.h.p., l.p., and l.p. underground cables, and incandescent electric lamps. (See this issue.)

Belfast.—March 3rd. Electricity Department. Supply of stores for 12 months, commencing April 1st, 1930. (See this issue.)

Belgium.—February 18th. Belgian State Railway Exploitation Co. 84½ kilometres of armoured cable in four lots and 12 kilometres of telephone cable. Particulars (Cahier des Charges Special No. 38,920) for 3 francs from 17, Rue de Louvain, Brussels.

Bexley.—Electricity Department. One 1,400-kVA Scott-connected transformer bank, switchgear, and cables. (February 7th.)

Blackburn.—March 10th. Electricity Committee. Supply of paper-insulated lead-sheathed cables, rubber-insulated wire, meters, and gasfilled and vacuum lamps for twelve months ending March 31st, 1931. (See this issue.)

Blackpool.—February 17th, 1930. Town Council. Electrical sundries required during the year 1930-31. Specification (No. 9) from Borough Treasurer, Town Hall.

Brentford.—February 26th. Union Guardians. Provision of a central switchboard and the laying of mains at the West Middlesex Hospital, Isleworth. (February 7th.)

Bristol.—February 26th. Board of Guardians. Electrical fittings for six months. T. S. Lamb, clerk, St. Peter's Hospital.

Edinburgh.—March 24th. Corporation. Supply for twelve months from May 16th, 1930, of underground insulated cables, underground conduits, pavement and road box frames and covers, house service fuse boxes and fuse boards, meters, link disconnecting boxes and cable dividing boxes. (See this issue.)

Egypt.—ALEXANDRIA.—Supply of miscellaneous electrical material for the Royal yachts. (B.X. 6133.)*

Glasgow.—February 17th. Education Authority. Installation of electric lighting in the temporary school at Govan. Specification from the Education Office, Bath Street.

Halifax.—March 3rd. Town Council. Electricians' work required in connection with the erection of public conveniences. Specification (deposit £1 1s.) from A. C. Tipple, borough engineer.

Hull.—February 20th. Electricity Department. Supply and erection of one water-cooling tower and two motor-driven vertical spindle drainage pumps, and supply and laying of cast-iron circulating water pipes. (January 31st.)

Leeds.—February 18th. Electricity Department. Supply of stores during the year ending March 31st, 1931. (January 31st.)
February 19th. Education Committee. Electrical work required in repairs to school buildings during year ending March 31st, 1931. Particulars from Architect's Section, Education Offices, Calverley Street, Leeds.

London.—CENTRAL ELECTRICITY BOARD.—February 22nd. Supply, delivery, and erection of transformer oil treating plant for 18 transformer stations in the Central England Electricity Scheme. (January 31st.)
March 3rd. Construction of site works, foundation works, and buildings in the area of the South-East England Electricity Scheme. (February 7th.)
HAMMERSMITH.—February 26th. Borough Council. Stores (including electric lighting sundries, cables, joint boxes, &c.) for 12 months. (January 24th.)
METROPOLITAN ASYLUMS BOARD.—February 19th. Installation of electric lighting at Woolwich and Lambeth casual wards, conversion of workshop power units to electricity at Darenth Training College, and installation of wireless receiving apparatus at Northern Hospital. (February 7th.)
BETHNAL GREEN.—February 20th. Borough Council. Electric lighting installations at four blocks of tenement dwellings. (February 7th.)
February 24th. Supply of pre-payment meters. (See this issue.)

Leicester.—March 7th. Corporation. Installation and fixing of wiring and fittings for electric lighting, &c., at the Belgrave pumping station. (See this issue.)

Morocco.—RABAT.—March 11th. Posts and Telephones Administration of the French Zone. Glass insulators, bronze and copper wire, galvanised ironwork. (B.X. 6410.)*

New Zealand.—WELLINGTON.—Post and Telegraph Department. March 24th. Resistances and reactances. (B.X. 6046.)*
March 5th. V.i.r. wire. (B.X. 6089.)*
April 29th. Public Works Department. One 10,000-kVA synchronous condenser and accessories. (B.X. 6034.)* Single-phase transformers and accessories. (B.X. 6035.)*
May 6th. 750-kVA transformers for Arapuni power scheme. (B.X. 6095.)*
May 13th. 110-kV transformers for Mangahao power scheme. (B.X. 6096.)*

Plymouth.—February 20th. Corporation. Supply of meters, cables (paper insulated), and transformers. (January 31st.)

Prestwich.—March 10th. Urban District Council. Electric lamps required during the year 1930-31. Form of tender, &c., from H. T. Ainsworth, surveyor to U.D.C., Town Hall.

Salford.—February 20th. Education Committee. Electric lighting installation at Tootal Drive School. Particulars from Secretary for Education, Education Offices, Chapel Street.

South Africa.—JOHANNESBURG.—March 20th. Railways and Harbours. Two 150-kVA motor alternators for Durban. (B.X. 6115.)*
CAPE TOWN.—April 2nd. Electricity Department. Five sets of electrically-driven pumps, with accessories, &c. (A.X. 9096.)*

Southend-on-Sea.—March 3rd. Corporation. Supply of general stores for 12 months, commencing April 1st, 1930. (February 7th.)

Stockport.—February 18th. Electricity Department. One 60-ton electric crane and gantry. Specification from R. Lee, borough electrical engineer, Electricity Offices, 23, Tiviot Dale.

Sweden.—GOTHENBURG.—March 3rd. Harbour Authority. Ten 2½ metric ton, electrically-operated portal cranes. (A.X. 9089.)*

Wimbledon. — February 17th. Corporation. Supply, delivery, and erection of one 7,500-kW, 2-phase, turbo-alternator, condensing plant and auxiliaries. (January 31st.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

Contracts Closed.

Blackburn.—Town Council. Accepted :—
Electric lighting installation at the Free Library.—J. Marsden (Blackburn).

Bradford.—Tramways Committee.
60 tons of hand-brake shoes (£517), and 60 tons of brake blocks (£510).—Yorkshire Repetition Casting Co., Ltd.
Rewinding 100 tramcar motors (at £96 15s. 6d. per motor).—English Electric Co., Ltd.
Baths Committee.
Electric lighting at Thornton District new public baths (£234).—F. Ashcroft.

Chesterfield.—Town Council. Accepted :—
L.p. cables (£955).—Macintosh Cable Co., Ltd.

Doncaster.—Electricity Committee.
Supply to Wheatley Mills :—E.h.p. cables (£465).—Callender's Cable & Construction Co., Ltd.
L.P. cables (£1,057).—Enfield Cable Works, Ltd.
Kiosk sub-station (£140).—W. Lucy & Co.

Glasgow.—Health Committee. Recommended :—
Electrical work at observation ward, Belvidere Hospital (£890).—Malcolm & Allan, Ltd.
Tramways Department.
2,000 Cosmos traction lamps.—Metro-Vick Supplies.

Heston & Isleworth.—U.D.C. Accepted :—
Improvement to the street lighting system in Hounslow High Street and London Road (£1,849).—General Electric Co., Ltd.

Liverpool.—Clarence Dock Power Station Special Committee. Recommended :—
Plant for Clarence Dock Power Station.—Four steel chimneys (£7,725).—Markham & Co., Ltd.
Two control batteries (£2,929).—Tudor Accumulator Co., Ltd.
3,300-V and 400-V armour-clad switchgear and low-voltage lighting and power distribution boards (£11,100); auxiliary switchgear (approx. £9,800).—British Thomson-Houston Co., Ltd.
Two battery charging motor generators (£477).—Lancashire Dynamo and Motor Co., Ltd.
Cable work in connection with the auxiliary switchgear and the lighting, telephones, call signals, heating, &c. (£7,600).—E.P.I. Ltd.
Passenger and goods lift (£840).—H. Morris, Ltd.
Chlorinisation plant (£640).—Paterson Engineering Co., Ltd.

Tramways and Electric Power and Lighting Committee. Recommended :—
5,000 copper bonds (£626).—T. Bolton & Sons.
300 copper bonds (£60).—British Insulated Cables, Ltd.
Special trackwork (£1,330).—Edgar Allen & Co.

London.—LONDON COUNTY COUNCIL.—Highways Committee. Accepted :—
Controller segments, &c. (£663).—E. Showell & Sons, Ltd. Ltd.
Tramway conductor rails (£7,232).—Frodingham Iron and Steel Co., Ltd.

Manchester.—Transport Committee.
Electrical installation at the Princess Road motor 'bus garage.—Maitland & Co. (Manchester), Ltd.
Electricity Committee.
33,000-V feeder reactors for Barton station.—British Thomson-Houston Co., Ltd.
Steam tubes and fittings for 6 months.—J. Russell and Sons, Ltd.
Transport battery replacements.— D. P. Battery Co., Ltd.
Sub-station kiosk and switchgear.—English Electric Co., Ltd.

Newbury.—Town Council. Accepted :—
Electric motors, starting gear, centrifugal pumps, and ancillary works for the sewage pumping station (£818).—R. E. Smart & Co.

Plymouth.—Electricity Committee. Accepted :—
Supply of switchgear for 12 months.—A. Reyrolle & Co. Ltd.

Portsmouth.—Electricity Committee.
Switchgear.—

Switchgear & Cowans, Ltd.	£45,537
Ferguson, Pailin, Ltd.	40,191
,, ,, Alternative	41,766
British Thomson-Houston Co., Ltd.	44,962
Metropolitan-Vickers Electrical Co., Ltd. ...	44,945
Johnson & Phillips, Ltd.	48,012
English Electric Co., Ltd.	40,191
,, ,, Alternative (Recommended)	41,760
General Electric Co., Ltd.	41,913
A. Reyrolle & Co., Ltd.	44,113
,, ,, Alternative	42,460
Park Royal Engineering Co., Ltd.	41,472
New Switchgear Construction Co., Ltd. ...	48,844

Rotherham.—Electricity Committee. Recommended :—
Oil filtering plant (£148).—Alpha-Laval Co. (De Laval).

Uruguay.—MONTEVIDEO.—State Electricity Department.
Machinery and plant for the new super power station comprising :—Two 25,000 kW turbo-generator sets, each with direct coupled exciter and 750 kW auxiliary alternator, condensing plant, water tube boiler equipment, switchgear, transformers, cable work, &c. (approximately £750,000).—Metropolitan Vickers Electrical Co., Ltd.
Further reference to this contract is made in our "Business Notes."

Forthcoming Events.

British Industries Fair.—Olympia, London, W.1, and Castle Bromwich, Birmingham. February 17th to 28th.

Physical Society.—Friday, February 14th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Electrical Contractors' Association of Scotland (Edinburgh Branch).—Friday, February 14th. North British Station Hotel, Edinburgh. Dinner, whist drive and dance.

Institution of Electrical Engineers.—Informal meeting. Institution, London, W.C. Monday, February 17th. 7 p.m. Discussion on "The Nickel-Iron Battery and its Uses," opened by Messrs. E. Fox. and W. E. Warrilow, and "The Lead Battery and its Uses," Mr. E. C. McKinnon.

(Irish Local Centre).—Thursday, February 20th. Trinity College, Dublin. 7.45 p.m. "The Analysis and Measurement of the Noise Emitted by Machinery." Mr. B. A. G. Churcher and Mr. A. J. King.

(Mersey and North Wales (Liverpool) Centre).—Monday, February 17th. University, Liverpool. 7.30 p.m. Faraday Lecture. "Broadcasting by Electric Waves." Capt. P. P. Eckersley.

(North-Western Centre).—Tuesday, February 18th. Engineers' Club., Manchester. 7 p.m. "Instrument Transformers." Mr. J. G. Wellings and Mr. C. G. Mayo.

(Hampshire Sub-Centre).—Thursday, February 20th. Portsmouth. 7.30 p.m. Conversazione.

(Sheffield Sub-Centre).—Wednesday, February 19th. Royal Victoria Hotel, Sheffield. 7.30 p.m. Address by the President.

(Scottish Students' Section).—Wednesday, February 19th. Royal Technical College, Glasgow. 7.30 p.m. "Electric Traction." Lt.-Col. H. E. O'Brien.

(London Students' Section).—Friday, February 21st. Institution, London, W.C. 6.15 p.m. "Paper-Insulated Power Cables." Mr. S. H. Hart.

(North Midland Students' Section).—Tuesday, February 18th. Hotel Metropole, Leeds. 7.15 p.m. "Steam *v.* Electricity for the Drive of Auxiliaries in Power Plants," to be opened by Mr. C. S. T. Paul.

Institute of Wireless Technology.—Monday, February 17th. Engineer's Club, Coventry Street, W. 7.30 p.m. Discussion on "Aerial Design for Short Wave Transmission."

Illuminating Engineering Society.—Tuesday, February 18th. Lighting Service Bureau, 15, Savoy Street, W.C. 7 p.m. "Modern Incandescent Lighting in Kinema Studios." Mr. W. H. Villiers.

Association of Supervising Electrical Engineers.—Tuesday, February 18th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "H.P. Heating of Water and its Application to Large Buildings." Mr. F. Selley. Saturday, February 22nd. Hotel Cecil. Annual dinner.

Overhead Lines Association.—Wednesday, February 19th. Institution of Electrical Engineers, Savoy Place, W.C. 5.30 p.m. "Rural Electrification." Mr. W. P. Gauvain.

British Electrical Development Association.—N.W. AREA SALES CONFERENCE. Wednesday, February 19th. E.D.A. Demonstration Bureau, Manchester. 6.30 p.m. "Personal Salesmanship in the Electrical Industry." Miss G. Burlton. LONDON CONFERENCE.—Friday, February 21st. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. "The Electrical Industry and the Architect." Mr. C. H. Flower.

British Institute of Radiology (incorporated with The Rontgen Society).—Thursday, February 20th. 32, Welbeck Street, W. 8.30 p.m. Ordinary meeting.

Electrical Power Engineers' Association (Birmingham Local Technical Group).—Thursday, February 20th. Midland Institute, Birmingham. 7.45. p.m. "Modern Steam Generators." Mr. P. E. Rycroft.

Junior Institution of Engineers.—Friday, February 21st. 39, Victoria Street, S.W. 7.30 p.m. "The Application of Electric Welding to the Erection and Strengthening of Steel Structures." Mr. E. P. S. Gardner.

Institution of Mechanical Engineers.—Friday, February 21st. Institution, Storey's Gate, S.W. 6 p.m. Annual general meeting.

Large Italian Power Cable.

A new electric power "cable," described by *The Times* as the largest in Italy and one of the largest in Europe and America, has just been brought into service. The "cable" is about 150 miles long, and conveys power at 240,000 volts, generated at the Cardano (Bolzano) station, from the Upper Adige to the most important industrial centres of Lombardy and Piedmont. This is the first time that these three regions have been joined by a "single electric cable." The "cable" was laid in ten months, a daily average of 400 workmen being employed.

Notes.

Electricity in Mines.

The Secretary for Mines draws attention to the publication of a new edition of the handbook of explanatory notes by H.M. Electrical Inspector of Mines on the general regulations governing the installation and use of electricity at mines under the Coal Mines Act, 1911. The handbook is intended to serve as a practical guide to mine managers, electricians, mechanics, and others in carrying out their duties under the regulations, in the choice of safe and suitable plant, in its safe installation and efficient maintenance, and generally in the observance of those precautions which experience has shown to be necessary for the prevention of accidents. The previous edition was published in 1924, and a good many notes on developments in practice since then have been added, including suggestions on the following points:—

(1) The necessity for prompt automatic isolation of a faulty circuit, preferably by leakage protection, to make earthing an effective safeguarding against electric shock, and an additional precaution against open sparking in cables.

(2) The application of remote control to coal-cutting machines and other coal-face machinery as a means (in particular) of reducing the risk of open sparking at the machine by removing the troublesome starting switch from the machine.

(3) The frequency with which certain tests and detail examinations, covering all parts of the electrical installation, should be made by the electrician, so as to anticipate serious defects and so avoid possible danger.

(4) The provision of permanent and safe means for earthing the conductors of a circuit, especially upon high-voltage systems, before men are set to work upon them.

(5) The utility of "pliable armoured cable" for the service of conveyors and similar semi-portable machinery.

The new edition (which for convenience of reference is numbered "Mines and Quarries Form No. 11, January, 1930") can be purchased (price 6d. or by post 8d.) through any bookseller or directly from H.M. Stationery Office.

An Extraordinary Time Signal Proposal.

Mr. R. R. P. Emanuel, of the Bhatpara Power Co., Ltd., India, sends us a newspaper cutting announcing that the Bombay Corporation is to ask the electricity supply company to switch off the lighting for three seconds every evening as a time signal. Our correspondent asks what our large Home cities, industrial works, and hospitals would say to being placed in darkness for three seconds daily. We believe that the system has been adopted by small undertakings in the past, but the results in a city the size of Bombay would be calamitous. It is hardly probable that this drastic form of time signal will be adopted, we think.

Diesel-Electric Locomotives for India.

It is of interest to note that the General Electric Co., Ltd., has recently completed the electrical equipment for two Diesel-electric locomotives for the North-Western Railway, India, this equipment having been made throughout at the company's Witton works in accordance with the Oerlikon system. These locomotives were made to the order of the High Commissioner, in conjunction with the consultng engineers for the work, Messrs. Rendel, Palmer & Tritton. The locomotives each weigh approximately 50 tons in working order, and are of the double-bogie type. They are each equipped with a 350-b.h.p. Beardmore high-speed Diesel engine, directly-coupled to a single-bearing generator with an overhung exciter. The generator supplies current to four

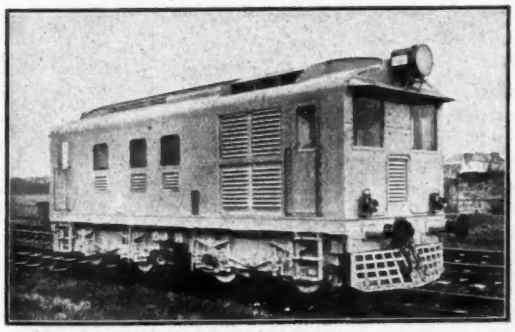


Fig. 1.—N.W. Railway, India, New Locomotive.

traction motors mounted upon the bogie axles, control being effected by master controllers located in the driver's cabs at either end of the locomotive. The locomotives are designed to haul loads up to 100 tons at a maximum speed on the level of approximately 47 m.p.h., and at correspondingly less speeds on gradients up to 1 in 50. The engine is started by motoring the generator from a storage battery which floats across the exciter circuit and provides a low-pressure supply for the lighting and the control circuits. The primary control of the locomotive speed is by remote control of the engine throttle, this being effected from the master controller at either end of the locomotive. The Diesel-electric power unit has self-regulating properties, the main generator being provided with a differential series field winding, in addition to a shunt field winding, so arranged that the locomotive characteristics ensure that, corresponding to the particular throttle position, the locomotive accelerates automatically up to its balancing speed. The controls are very simply arranged, push buttons being provided both to start and to stop the engine, with speed

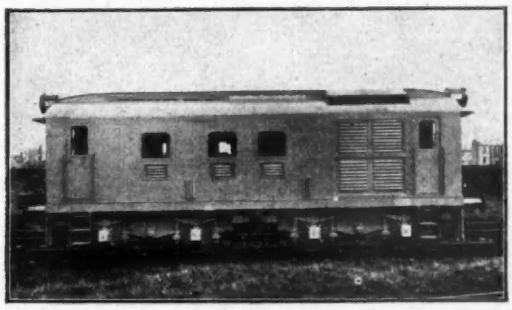


Fig. 2.—Diesel-electric Locomotive for India.

control effected by the movement of an electrical controller giving five running positions. The locomotives are designed for the Indian track gauge of 5 ft. 6 in., but the bogies of one locomotive are being modified to the standard British gauge of 4 ft. 8½ in. to enable a number of tests to be conducted on the locomotive before shipment. The locomotives will be shipped complete from Messrs. Beardmore's wharf at Dalmuir, Glasgow. Figs. 1 and 2 show, respectively, end-side and side views of one of the locomotives.

Appointments Vacant.

Engineer and manager of Cardiff Rural District Council's electricity undertaking. Temporary electrical engineer and manager for Hazel Grove and Bramhall Urban District Council. Showroom manager and salesman for Nottingham Corporation. Two junior technical officers for the Admiralty Technical Pool at an experimental establishment. Shift engineer for Perth Corporation. Shift charge engineer for St. Helens Corporation. Plumber-jointer for Barrow-in-Furness Corporation. Station superintendent and installation engineer for Newport (Mon.) Corporation. Resident electrical engineer for Penmaenmawr Urban District Council. (See our advertisement pages to-day.)

The Perak River Hydro-Electric Scheme.

In the description of Selibin sub-station given in our issue of January 31st, it should have been stated that the power transformers were supplied by A.S.E.A. Electric Ltd., the instrument transformers only being supplied by the Metro-Vickers Co. with the switchgear.

We are informed that with the exception of a few lighting transformers of 50 kVA total capacity all the power transformers installed on this scheme, numbering to date about 130, with an aggregate capacity of some 120,000 kVA, are of A.S.E.A. manufacture, and were built at Walthamstow, London.

Electric Winding Engines for Japanese Collieries.

Electric winding engines have recently been installed at the Okinoyama, Kamiyamada, and Tadakuma collieries in Japan, all being of the twin-rope haulage type. At the Okinoyama pit the shaft is vertical and only 310 ft. deep. The motor, which runs at 360 r.p.m., normally develops 355 h.p. and drives the actual winder at 43 r.p.m. through spur gearing. The winding speed is 1,240 ft. per min., and with four tubs per cage 382 tons of coal per hour can be raised. At the Kamiyamada mine the vertical shaft is 1,350 ft. deep. The motor in this case has a normal output of 1,220 h.p. at 54 r.p.m. and is directly coupled to the winder. The winding speed is 2,580 ft. per min., the lifting capacity being 150 tons per hour. The working conditions at the Tadakuma mine are somewhat different to those at the other two pits. In this case haulage is effected along an incline at an angle of 45 deg. to the horizontal. The coal is filled underground into a skip, which is hauled to the surface along a rail track, an empty skip descending at the same time. When the loaded skip arrives at the pit head, its contents are discharged into a hopper by means of special tipping mechanism, the coal being then carried by band conveyors to the washing plant, the sorting equipment, &c. The motor, which normally develops 290 h.p. at 350 r.p.m., drives the winder at 29.3 r.p.m. through spur gearing, 120 tons per hour being raised along the 1,320-ft. hoisting track. All three sets of plant are controlled on the Ward-Leonard system; however, to equalise the severe load fluctuations inevitable in winding operations a heavy A.E.G. Ilgner-system flywheel is coupled with the Ward-Leonard motor-generator.

" Watts in a Home."

The Electrical Association for Women introduced yet another attractive method of propagating the domestic electrical idea by producing a play entitled " Watts in a Home " at the Rudolph Steiner Hall, Park Road, N.W.1, on February 11th. The action of the play commences in 1880 in a Victorian parlour, lighted by oil lamps and candles, with the introduction of a box which produces sparks and shocks to the terror of the household. This is followed in the course of four acts by the carbon, metal-filament, and gasfilled lamps, and from the glare of the exposed filament to the present-day anti-glare lighting fittings. The plot is cleverly interwoven

Levare] [*London.*

Miss José Shannon.

with the shocks and romance of electric lighting, and its early nursing by enthusiasts who in their turn become old people intolerant of anything " modern." The lighting arrangements were superintended by stage electricians, and the production of the play was in the capable hands of Miss José Shannon. A strong cast included Vera and Sophie Norvick, Jean Hinchliff, Ethel M. Dickinson, Olive Jackson, José Shannon, who gave a finished performance, first as Annie Leeson, and later as Mrs. Tobias L. Jolly, Messrs. Valentine Nicholls, Dudley C. Apps, and Dudley C. Pearman, who doubled the parts of Tobias Jolly and Captain Bucks. Miss Caroline Haslett, Director of the Association, inspired the production of the play, which was cordially received by a large audience.

Earth Temperatures and Cable Ratings.

A report has been issued by the National Electric Light Association (U.S.A.) as a result of a special study on earth temperatures. The three principal methods of measuring temperatures are analysed, and the relations between air and earth temperatures discussed.

The following general conclusions are drawn :—

1. The earth temperature varies with the depth below the surface, the maximum decreasing and the minimum increasing with the depth.
2. The temperature at the same depth varies due to the influence of the soil conditions, adjacent sources of heat and the heat received from solar radiation.
3. The earth temperature at one particular locality seems to repeat itself with reasonable accuracy each year, following a cyclic almost sinusoidal curve.
4. In calculating cable ratings tolerances should be allowed to account for variations at different points in the same city.
5. The presence of paving and a high percentage of moisture in the soil in most cases increase the maximum summer and decrease the minimum winter temperatures.
6. Below a depth, which may be somewhere between 25 and 80 ft. below the surface, the earth temperature has no seasonal variations.
7. For any one locality the variations in earth temperature with depth, follow a definite law, although the same relation does not hold for all localities.
8. There is no consistent relation between the mean air and earth temperatures, the difference between the mean monthly air temperature and the earth temperature for each month at any depth varying for each city.
9. The maximum and minimum earth temperatures lag behind the corresponding air temperatures by a period which increases progressively with the depth, the lag at the surface being practically zero.
10. Further study may develop a means of calculating the monthly variation of earth temperature from the monthly mean air temperature. As the earth temperatures are readily determined, the value of such theoretical means of earth temperature determination is questionable.

A Theory of Positive Electricity.

In the proceedings of the Royal Society for January, Dr. P. A. M. Dirac propounds a theory of positive electricity. The relativity quantum theory of an electron leads to a wave equation with solutions corresponding to negative energies, considering the energy of the electron as positive. Electrons have a tendency to fall into negative energy states (accompanied by emission of radiation) since the stable states of an electron are those of lowest energy. This tendency is counteracted by the Pauli exclusion principle, which prevents more than one electron from going to any one state. As there is an infinite number of electrons in any given volume they will be undetectable, if uniformly distributed, and only the few missing states of negative energy will level themselves to observation. The latter may be regarded as " things of positive energy," *i.e.*, protons.

The difficulty of dealing with the presence of negative electricity of infinite density, as in ordinary electromagnetic theory, is obviated by assuming that volume-charges must be measured by departures from a normal state of electrification, in which every electronic state of negative energy, but none of positive energy, is occupied.

Tramways and Light Railways in 1928-29.

The returns of tramways and light railways (street and road) and trackless trolley undertakings for 1928-29 show 221 concerns (against 233 in 1927-28), of which 161 (against 167) were owned by local authorities. Nine of the undertakings were not operated during the period and seven were not open for traffic at the end of the period. It is stated that in eight cases tramway operation was abandoned and the track removed, while in a further four cases powers were terminated by Order and these undertakings have been deleted from the returns. The cessation of tramway operation in an additional eight cases is recorded, and powers were terminated by Order in another case. The capital expenditure on tramway undertakings was as follows :—Local authorities, £81,573,886; companies, £18,924,849; total, £100,498,735. The local authorities' gross receipts were £23,292,621 (against £23,860,767), working expenses, £18,332,185 (against £18,663,222), net receipts, £4,960,436 (£5,197,545). The equivalent figures for the companies were: gross receipts, £3,774,593 (£3,890,737), working expenses, £3,147,550 (£3,279,925), net receipts, £627,043 (£610,812). The combined net receipts were therefore £5,587,479, against £5,808,357. The number of passengers carried decreased by 1.75 per cent. to 4,623,258,679. The quantity of electrical energy used rose from 794,175,338 kWh to 817,492,187 kWh. The average fare paid per passenger fell from 1.39d. to 1.38d. At the end of the period there were 23 railless trolley vehicle undertakings (21 municipal). The capital expenditure amounted to £1,379,385 (municipalities £1,171,203); the gross receipts to £616,950 (£575,953) and the net receipts £155,755 (£152,133).

Floodlighting an Ancient Inn.

The " Plough Inn " at Clapham, which has been a notable London landmark for many years past, has lately been reconstructed by Messrs. Caterers, Ltd., and the spacious new building which now stands on the site is probably destined to become an even more notable landmark than its predecessor. Its ambitious scheme of electric lighting should assist it to do so. The whole frontage has been illuminated

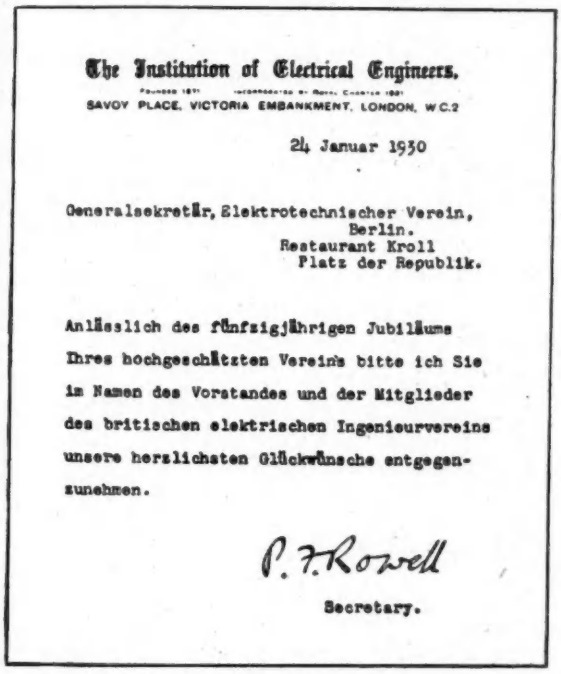
The " Plough Inn " Floodlighted.

by means of powerful G.E.C. floodlights, equipped with " Osram " gasfilled lamps, and these units are mounted in large decorative lanterns of striking design, which are in keeping with the Tudor style of the exterior of the building. They are supported by tastefully-designed wrought-iron brackets mounted on massive square oak pillars let into the pavement near the edge of the kerb. The panels of the lanterns are glazed with clear glass on the sides facing the building, and with white morocco diffusing glass on the three remaining sides. From the clear side of each lantern powerful beams of light are directed upon the facade of the building, at the same time illuminating the pavement by

indirect lighting from the building, while pilot lamps fitted behind the projectors in each lantern render the darkened three sides luminous, in order to relieve the black appearance that would otherwise result from the metal casings of the floodlighting units. The floodlighting units and their supports, as well as the suspended signs which carry the emblem and title of "The Plough Inn," were designed and supplied by the General Electric Co., Ltd. The wiring is carried in grooves up the sides of the pillars, and concealed by wood fillets with matched graining. The electrical contractors responsible for the work were Messrs. Duncan Watson & Co. The accompanying illustration, fig. 3, depicts the floodlighting effect.

The Elektrotechnischer Verein Jubilee.

At the jubilee meeting of the Elektrotechnischer Verein, which was held in Berlin, Germany, at the end of January, a message of congratulation from the British Institution of Electrical Engineers was received by the general secretary and read aloud to the meeting by the president, Prof. Dr. Wagner. The message was sent from London in the form of a letter, which was transmitted to Berlin by means of the Post Office's recently-inaugurated facsimile photo-telegraph Anglo-Continental service. Mr. Ll. B. Atkinson, who attended the meeting, was able to obtain the loan of the actual message received, and by his courtesy we are able to reproduce a photographic copy of it herewith, fig. 4.



The Institution of Electrical Engineers.

SAVOY PLACE, VICTORIA EMBANKMENT, LONDON, W.C.2

24 Januar 1930

Generalsekretär, Elektrotechnischer Verein,
Berlin.
Restaurant Kroll
Platz der Republik.

Anläßlich des fünfzigjährigen Jubiläums
Ihres hochgeschätzten Vereins bitte ich Sie
in Namen des Vorstandes und der Mitglieder
des britischen elektrischen Ingenieurvereins
unsere herzlichsten Glückwünsche entgegen-
zunehmen.

P. F. Rowell

Secretary.

Fig. 4.—Copy of Photo-telegraphed Message.

Battersea Power Station.

The General Purposes Committee of the London County Council, *The Times* states, considers that no action on the part of the Council would appear to be called for at the present time on the interim reports of the advisers to the London Power Company and of the committee presided over by the Government chemist on the treatment of sulphur fumes in connection with the proposed new power station at Battersea.

Reference is made to what is being done at the power stations at Lots Road, Chelsea, and Great College Street, St. Pancras. At the former station the cylonic method of dust separation is being used and has resulted in a fair measure of success, but it is submitted that the sulphurous gases are unaffected by the apparatus. At the St. Pancras generating station the system of washing the flue gases is employed, and the comment is made that from analyses of samples of the effluent it has been found that a proportion of the sulphur emitted with the flue gases or smoke has been absorbed. The Public Control Committee is advised that it would appear that the washing of flue gases is a suitable method of dealing with the deleterious constituents of smoke. The principal difficulties in connection with the system are the provision of an adequate water supply, and the disposal of the sludge and acid effluent. Operating costs are largely governed by these factors.

It is understood that the method proposed to be adopted at the Battersea power station is a combination of the cyclonic and water washing systems. In order to contribute to the success of this method it would appear to be equally important that, in addition to containing a low proportion of sulphur, the coal used should be of low ash content.

The Public Control Committee is of opinion that it would be advisable to await the final reports of the committee presided over by the Government chemist, and of the advisers to the London Power Company, before expressing a final opinion on the proposed method of controlling the emission of smoke and grit at the Battersea station.

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—At an informal meeting of the Institution on February 3rd (Mr. A. Morgan in the chair), Mr. H. G. S. Peck opened a discussion on "The Maintenance of Telephone Plant," and described the elaborate system of routine overhauls of the various sections of the telephone service. Adequate factors of safety, especially in the case of electro-mechanical apparatus, had not always been provided in the past, but the qualities of reliability and accessibility were now receivng much greater attention.

Faraday Lecture.—PLYMOUTH'S RADIO STATION.—"Broadcasting by Electric Waves" is the title of the Faraday Lecture which is being delivered by Captain P. P. Eckersley, until recently chief engineer of the British Broadcasting Corporation, before the provincial Centres of the Institution. In introducing the lecturer at the Western Centre, the Commander-in-Chief at Plymouth, Admiral Sir Hubert Brand, explained that the Faraday Lecture was originated by the Council of the Institution with the object of increasing the interest of the general public in electrical matters. It was founded in memory of Michael Faraday, who laid the foundation of the electrical industry. Captain Eckersley thought the fundamental basis of wireless was that it extended the power of hearing. Part of the national wireless scheme should be, therfore, that all people should have equal facilities for hearing. Every station had a certain service area, an area in which people could hear the progammes free from interruption. The problem of the transmitter was to overcome interference, and in Plymouth, though they had a fairly strong local station, there had previously been some complaint that there was a certain amount of spark jamming, due probably to naval operations. Instead of the B.B.C. having to raise the power of the station, the naval authorities had been most generous and had done everything they could to try and eliminate that interference. The B.B.C. was very grateful for the co-operation it received from the Fleet. What the B.B.C. wanted to do was to include everyone in the British Isles in one programme or another. An enormous number of people were finding in wireless something they might never have had without their crystal sets, but he was inclined to think that the days of the crystal set were almost done, because the valve set had become so efficient and so relatively cheap to maintain and in first cost. The regional system was to provide alternative programmes; they had ten wave-lengths with which they had to so cover Great Britain that people would have a choice of programmes. There would be five centres, but only 85 per cent. of the people of the British Isles would get an alternative programme. Plymouth was not one of those places, and would not get an alternative programme in the true sense of the word, at least not until the B.B.C. got the wave-lengths which were most suitable to broadcasting. The present wave-lengths used by the maritime services were superb for broadcasting, and the wave-lengths used for broadcasting were superb for the maritime services, but hitherto the idea of "swopping" had made no headway, though as a technician he assured them that to "swop" would be of supreme advantage to both. The West of England regional station would not be sufficient to give an alternative programme in Plymouth, but if that interchange were made they would have alternative programmes from Daventry and from the new station which would probably be erected somewhere on the Quantock Hills, in West Somerset. The local station, however, would remain until the Government listened to the plea of the technician. He thought that point should be driven home, because it influenced all good conditions of broadcasting in that area. In the regional scheme he had not been able to give the whole of England alternative programmes, but 85 per cent. was an achievement which was unique in the world. The reception problem had to be studied in terms of service for service areas. He looked forward to the time when they would touch a single button and get Prague, when women would be allowed to touch a wireless set, a machine that a fool could operate. Reception must be real; broadcasting was a revolution in our time as great as the invention of the written word. Broadcasting made a marvellous appeal, it was direct and actual. He would rather hear a man speak than read a verbatim report. It might dawn on people that foreigners were not foreigners, but human beings as well as themselves, and that it was not necessary to re-arrange their difficulties in terms of killing people. The idea of peace would gain greatly from the power of broadcasting; it was a means of getting people to appreciate that they were citizens of the world, not merely people enclosed by artificial barriers. If broadcasting did that, he would be wonderfully proud of it.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. P. H. NYE, of the Shanghai branch of the General Electric Co. of China, Ltd., is returning to England, and Mr. N. G. BEALE, who for some years has been chief engineer for the company in China, has been appointed to succeed him as general manager in that territory.

The Rotherham Corporation Electricity Committee recommends that the salary of the deputy electrical engineer, Mr. W. H. DUFFETT, be increased from £900 to £1,000 per annum.

The Gloucester City Council has increased the salary of the city electrical engineer (Mr. F. H. CORSON) by £100, the amount which he received whilst acting as general manager of the transport undertaking.

The Oldham Corporation Tramways Committee has appointed Mr. A. DICKSON, now garage superintendent, as rolling stock superintendent at a salary of £400 per annum.

From 33 applicants, Mr. C. H. STAFFORD, deputy manager and assistant engineer of the Reading tramways, has been appointed manager of the Burnley Corporation Tramways and Transport Department in succession to Mr. H. Mozley, who retires on superannuation. Mr. Stafford is 39 years of age, and an Associate of the Institute of Transport. After service with a Birmingham firm of electrical engineers, he became power station engineer at Reading in 1912. Afterwards he became assistant engineer to Reading Tramways Department, and in 1928 was appointed deputy manager.

Consequent upon the death of Mr. T. Baxendale, power stations engineer, the following appointments have been made by the Manchester Corporation:—Mr. S. A. RUSSELL, resident engineer, Barton station, to be power stations engineer; Mr. W. E. PLOWMAN, resident engineer, Stuart Street station, to be resident engineer, Barton station; and Mr. A. WILLIAMS, assistant engineer, Barton, to be resident engineer, Stuart Street.

Mr. W. THYNE, manager for Canterbury and district for the Post Office telephones, has been promoted as manager of the West of Scotland district. Prior to going to Canterbury in 1927 he was staff officer for the Glasgow district.

At the Chelmsford works of Messrs. Crompton Parkinson, Ltd., on January 31st, presentations were made to Mr. H. CHURCH, M.C., M.I.E.E., and Mr. S. E. COLLIS on the occasion of their leaving the company to start an electrical engineering business in Chelmsford. Mr. Church has been manager of the factory for the manufacture of instruments, small motors, switchgear, &c., known as the "Lamp Shop" for the past eight years, and Mr. Collis has been associated with him. The presentation took the form of an oak desk, a fountain pen and a framed photograph of the management and foremen for Mr. Church, and a wristlet watch and pipe for Mr. Collis. The gifts were handed to the recipients by Colonel Hardie, D.S.O. (general manager at Chelmsford).

The Bermondsey Borough Council is to invite applications for the position of deputy borough electrical engineer, rendered vacant by the appointment of Mr. H. E. BLACKISTON to West Hartlepool, on the existing terms, *viz.*, £700, rising by three annual increments of £50 to £850 per annum.

Leeds Corporation Electricity Committee has recorded its high appreciation of the services rendered by Mr. C. N. HEFFORD, the manager, in connection with the design, construction, and equipment of the Kirkstall generating station and has decided that in recognition of those special services he shall be granted a sum equivalent to a half-year's salary now and a similar sum in three months' time.

The York City Council has appointed Mr. D. S. RICHARDS, of Newport, as installation superintendent in the Electricity Department.

At a gathering of the staff at Dellingburn electricity works, Greenock last week, Mr. H. H. PERNICE was presented with some travelling equipment on the occasion of his leaving the service to take up a Government appointment in Nigeria.

On Monday last the Wolverhampton Corporation appointed Mr. T. A. G. MARGARY borough electrical engineer and manager at a salary of £1,000, rising by annual increments of £50 to £1,200. The position has been vacant since August last when Mr. E. Morgan was appointed city electrical engineer of Sheffield. The post was originally advertised at a commencing salary of £850, but the Committee found that none of the applicants was suitable, and permission was obtained to offer the higher remuneration. Mr. Margary is at present distribution superintendent at Wolverhampton.

The Department of Overseas Trade announces that Sir H. H. Fox, K.B.E., C.M.G., resigned from the post of Commercial Counsellor at Peking on January 1st, and has retired on pension. His service in China has extended over forty years. It has been decided that the headquarters of the Commercial Diplomatic Service in China shall be transferred to Shanghai; Mr. H. H. BRETT, C.M.G., will accordingly remain there and he has been promoted to be Commercial Secretary, First Grade, with the local rank of Commercial Counsellor. Mr. A. H. GEORGE has been appointed Commercial Secretary, Second Grade, at Peking.

Mr. C. A. PIKE, resident electrical engineer to the Penmaenmawr Urban Council has been appointed manager of the Caernarvon electricity works which are being transferred from the National Electric Construction Co. to the Corporation. There were 115 candidates.

Mr. C. C. RATTEY, M.I.E.E., chairman of the Alton Battery Co., Ltd., has returned from his tour abroad. Mr. Rattey visited British Columbia, Japan, China, the Federated Malay States and Ceylon and in addition to furthering the company's interests with its agents has been able to successfully negotiate important contracts.

Mr. A. J. SPILLER, who has been connected with Simplex Conduits, Ltd., for thirty-two years, the last ten of which he has served in the capactity of secretary, has just been appointed a director of that company.

The Farnworth Urban District Council has permitted Mr. A. J. HUTCHINSON, its chief electrical engineer and general manager, to act as consulting engineer for a large extension scheme for the Turton Urban District Council.

We reproduce herewith the portrait of Mr. DAVID MAXWELL BUIST who has been appointed by the Central Electricity Board as district engineer for North-East England. Prior to his appointment Mr. Buist had been in charge of the electrical work at the Billingham factory of Synthetic Ammonia and Nitrates, Ltd. He was previously at Edinburgh and Hull.

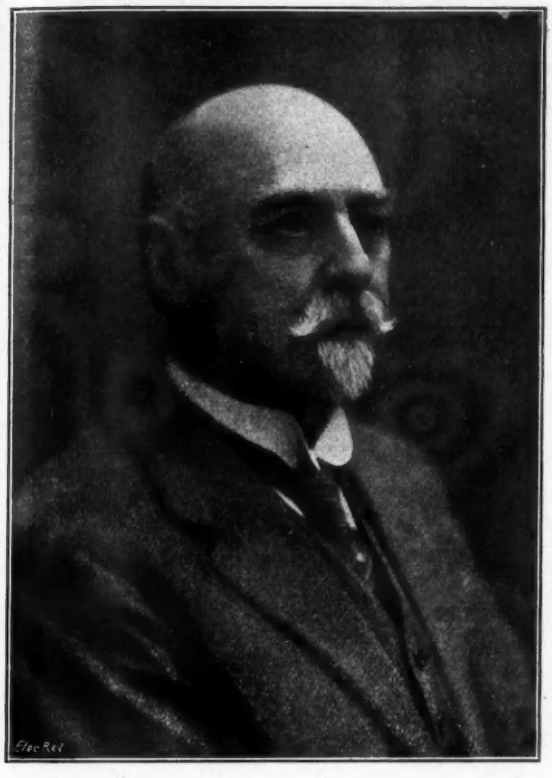
Elliott & Fry] [*London.*

Mr. D. M. Buist,

Who has been appointed district engineer for N.E. England.

Mr. HERBERT TAYLOR, foreman of railless trolley vehicles in the Bradford Corporation Tramways Department, has been appointed superintendent of rolling stock and overhead-wire vehicles at Darlington.

Obituary.—MR. S. W. BAYNES.—We regret to learn that Mr. Sydney W. Baynes, who was chief electrical engineer to the St. Pancras Borough Council from 1895 until December, 1927,



Elwin Neame] *[London.*

The late Mr. Sydney W. Baynes, M.I.E.E.

passed away on February 6th. Mr. Baynes will be remembered as one of the pioneers at Bradford and in London of the electricity supply industry at a time when it was easier for one to know more or less intimately every outstanding engineer in that then specialising class. In his early days he was the electrical engineer to the Forth Bridge works, afterwards carrying out contracts with the Central Argentine Railway and the Kensington and Knightsbridge Electric Lighting Co. For seven years he was chief engineer to the Bradford Corporation Electricity Department, and he came south in 1895 as stated and took up his position at St. Pancras, where he and his undertaking always occupied a prominent place in electricity supply development. He was enterprising in his adoption of new methods of production and distribution—plant, pressure, generation and distribution—so reducing the charges per unit as to render the St. Pancras system an example for low charges to many other undertakings throughout the Kingdom. We referred to some of his achievements in this column on the occasion of his retirement (ELEC. REV., November 25th, 1927, p. 914), due to ill-health. The Council, in accepting his resignation, expressed its regret, and placed on record its recognition and appreciation of his distinguished services. Mr. Baynes became an Associate of the Institution of Electrical Engineers in 1889, and had been a Member since 1891.

HERR S. V. FODOR.—The death recently occurred in Budapest, at the age of 73 years, of Herr Stephan V. Fodor, one of the pioneers of electric lighting. As the engineer of the original Compagnie Continentale Edison, a number of important electric lighting installations were carried out under his supervision in the 'eighties of last century, including those in the Winter Palace, St. Petersburg, and the Kremlin, Moscow. After similar work in Finland, Algiers, Egypt, and Greece, the deceased became associated with the Budapest General Electricity Co.

Mr. H. HOLGATE.—The death is reported of Mr. Henry Holgate a prominent Canadian engineer, who, in partnership with Mr. R. E. Ross, had carried out a great deal of hydro-electric construction in Canada, including the plant of the West Kootenay Power Co. and the Canadian Copper Co.

Mr. A. G. LUPTON.—We regret to report that Mr. Arnold Greenhow Lupton, chairman of the Yorkshire Electric Power Co., died at his home in Leeds on Saturday last, at the age of 79. Mr. Lupton had been prominently associated with educational work and was pro-chancellor and chairman of the council of Leeds University from its foundation in 1904 up to 1921.

Will.—The late Mr. SAMUEL WHITE, chairman of the Bristol Tramways and Carriage Co., Ltd., the Imperial Tramways, Ltd., and other companies, left estate valued at £297,490 (£267,352 net personalty). He made bequests to a number of his employés.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Mosbrough Electric Supply Co., Ltd.—Private company. Registered February 6th. Capital, £5,000 in £1 shares. Objects:—To carry on at Mosbrough and elsewhere in Derbyshire the business of an electric lighting and supply company, &c. The directors are: H. Clayton, address not stated; E. Peat, Longfield, Halfway, Sheffield; R. Peat, Vine Grove Farm, Mosbrough; J. Renwick, Eckington, near Sheffield, solicitor. Qualification: 100 shares. Secretary: H. Clayton. Solicitors: Hall & Renwick, Eckington, near Sheffield.

Kinetic Wireless and Electric Supplies, Ltd.—Private company. Registered February 5th. Capital, £2,500 in 1,900 ordinary and 600 8 per cent. cumulative preference shares of £1 each. Objects:—To acquire the business of a dealer in wireless, gramophone and electrical supplies now carried on by A. L. Chatfield, at 5, Godstone Road, Caterham, and 82, Godstone Road, Whyteleafe, Surrey, as "Kinetic Wireless and Electric Supplies." The permanent directors are: J. D. Ragg, Westview, Harestone Hill, Caterham Valley, Surrey; A. L. Chatfield and Mrs. Rose L. Chatfield, 5, Godstone Road, Caterham, Surrey. Qualification: £100 shares. Registered office: 5, Godstone Road, Caterham, Surrey.

Bailey & Incledon (1930), Ltd.—Private company. Registered February 5th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of electrical, mechanical and general engineers and contractors as formerly carried on by Bailey and Incledon, Ltd., at 34, Duke Street, St. James's, S.W., and to adopt an agreement with the said company and E. V. Weller. The directors are: H. J. North, 10, Rundell Crescent, Hendon, N.W.4, electrical contractor; P. W. Fitz, "Vicarage Farm," Enfield, electrical engineer (life directors). Secretary: H. J. North. Registered office: 34, Duke Street, St. James's, S.W.1.

T. Hall & Co., Ltd.—Private company. Registered February 4th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electricians, and mechanical and wireless engineers as formerly carried on by T. J. Hall at "Haslemere," Malden Road, Cheam, and High Street, Ashtead. The first directors are: T. J. Hall, "Haslemere," Malden Road, Cheam, electrical engineer (permanent managing director); J. F. Venner. "White Cottage," Cornwell Road, Cheam, accountant. Qualification: £100. Secretary: J. F. Venner. Registered office: 44, Malden Road, Cheam, Surrey.

Commercial Radiators, Ltd.—Private company. Registered February 7th. Capital, £700 in 10s. shares. Objects: To carry on the business of electrical, motor, mechanical and general engineers, to acquire British patent No. 293,635, and to adopt an agreement with E. F. Lyne and R. W. Wilkinson. The directors are: R. W. C. Wilkinson, 21, Hillfield Avenue, N.8, engineer; H. J. Latham, 92, Turnpike Lane, N.8, engineer; S. J. Lee, 16, Pulteney Road, South Woodford, E.18, accountant. Lyne, Frank & Wagstaff, Ltd., and C. B. King and Co., may each appoint one director while respectively holding 20 per cent. of the issued capital. Registered office: 4, Vicarage Mews, Blackboy Lane, N.15.

Shoolbred Electrical Co., Ltd.—Private company. Registered February 7th. Capital, £5,000 in £1 shares. Objects: To carry on the business of an electrical and general engineer carried by on H. G. Shoolbred, as "Shoolbred & Connell" at Luton and elsewhere, &c. The directors are: A. F. Plummer, Sunnymead, Sauncey Avenue, Harpenden, Herts., electrical engineer; H. G. Shoolbred, Hill House, Barton, Beds., electrical engineer (both permanent). Qualification: £25 shares. Solicitors: Knowles & Son, Luton.

Official Returns of Electrical Companies.

Central Wireless Co., Ltd.—Particulars filed of £300 debentures authorised by resolutions of January 22nd and 25th, 1930, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Jersey Electric Lighting & Power Co., Ltd.—Capital, £65,000 in 51,000 preference and 14,000 ordinary shares of £1 each. Return dated September 12th, 1929. 12,257 preference and 14,000 ordinary shares taken up. £26,257 paid, Mortgages and charges: £9,000.

Sydney Hellyar, Ltd.—Capital, £2,000 in £1 shares. Return dated September 25th, 1929. All shares taken up. £2,000 considered as paid. Mortgages and charges, nil.

Mead & Jeffery, Ltd.—Satisfaction in full on December 31st, 1929, of debenture dated July 23rd, and registered August 8th, 1919, securing £500.

City & General Radio Company, Ltd.—R. R. Goding, 46, Watling Street, E.C., was appointed receiver and manager on January 30th, 1930, under powers contained in debentures dated April 6th, 1926.

T. V. E. (Triplex-Blade Ventilating Engineering) Co., Ltd.—E. L. Lee, 25, Victoria Street, S.W., was appointed receiver on January 25th, 1930, under powers contained in instruments dated December 3rd, 1928, and January 29th, 1929.

Corona Lamp Works, Ltd.—W. W. B. Jackson, 65-66, Chancery Lane, W.C.2, was appointed receiver in place of the late V. G. Teale, on November 23rd, 1929, under powers contained in trust deed dated April 10th, 1919.

Power Construction Company, Ltd.—Satisfaction in full on January 29th, 1930, of charge dated November 9th, 1928, particulars of which were registered on November 13th, 1928, securing £7,300 and 50 per cent. of the profits to be derived from the mortgaged property.

Tredegars, Ltd.—Capital, £20,000 in £1 shares. Return dated November 6th, 1929. 11,077 shares taken up. £11,077 paid. Mortgages and charges: £6,000 (part of an authorised issue of £12,000).

British Illuminated Signs, Ltd.—Capital, £3,000 in 100 preference shares of £10 each and 2,000 ordinary shares of £1 each. Return dated January 3rd, 1929. All shares taken up. £3,000 paid. Mortgages and charges, nil.

Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd.—Capital, £15,000 in £1 shares. Return dated December 23rd, 1929. 11,500 shares taken up. £500 paid. £11,000 considered as paid. Mortgages and charges: £20,000.

O. S. Choppin & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 26th, 1929. 702 shares taken up. £2 paid. £700 considered as paid. Mortgages and charges, nil.

M.E.D.A.S., Ltd.—C. L. Porter, 36, Redcliffe Square, S.W.10, was appointed receiver and manager on January 29th, 1930, under powers contained in debentures dated June 14th, 1929.

City Notes.

Allgemeine Elektricitäts Gesellschaft.

The report of the directors for the year ended with September 30th, 1929, states that the electrical industry was satisfactorily occupied. Including the turnover of subsidiary companies, the value of the orders invoiced increased by 15 per cent. over that in the previous year and exceeded 580,000,000 marks. This is attributed to the greater competitive nature of the company's products in consequence of improvements in technical quality and manufacturing. Business is stated to be satisfactory at present, but home orders have declined, owing to the financial situation. The report states that the agreement made with the American General Electric Company is correct from a national economic point of view, and is of great advantage to the company. The agreement will improve the business in international markets and consequently the exports; it has rendered possible the conversion of the preference shares into ordinary shares and has brought to the company the necessary capital in the present general scarcity of money. Mention is made of the transfer of the company's low-pressure interests to the Standard Elektricitäts Gesellschaft, which is a holding concern and owns the majority of the shares in the telephone works of Ferd. C. Schuchhardt, and Mix and Genest.

The technical section is so comprehensive as to permit merely of a very brief summary. The construction of new works and the extensions of power stations took place in a greater measure than in the previous year. There was further progress in the combination of large networks by means of 110 and 220-kV lines on the one hand, and on the other an extension and strengthening of the l.p. networks. As a consequence of this development, the company projected and worked upon a large number of power stations. Specially noteworthy is the power station of the middle German Power Works Magdeburg Company, which is designed for 120,000 kW, and the "Else" steam power station of the Bavaria Works Company, near Schwandorf, which is in course of construction, of similar capacity. For the Rhine power station, Ryburg-Schworstadt, which has a total output of over 100,000 kW, the company received the order for the entire switching plant. The report proceeds to state that many large machines were supplied and set in operation, together with transformers and switching installations, including a number for a pressure of 220,000 V. An important development was the pressure gas switch, which is claimed to be far superior to the oil switch hitherto employed. Steady development took place in the turbine branch. Among the machines produced were two turbo sets each of 12,000 kW for a working pressure of 100 atmospheres, an 85,000-kW turbine running at 1,500 r.p.m. and two large turbo sets each of 50,000 kW for the Rhenish Westphalian Electricity Works. The railway electrification department was sufficiently occupied with the completion of the electric locomotives and motor coaches for the Reich railways ordered in the preceding year, but electrification was not further extended last year. The orders booked from the tramways and cross-country lines were satisfactory, and a few new lines were constructed. Among other matters the report refers to orders executed for the iron and steel and coal industries, and equipment for the chemical, paper, textile and sound film industries. As mentioned in the ELECTRICAL REVIEW of January 24th, the dividend is increased from 8 per cent. to 9 per cent. for 1928-29.

Singapore Traction Co., Ltd.

The accounts of this company were reviewed in our issue of January 31st, p. 221. The annual meeting was held on February 5th, when Mr. L. W. Hawkins (chairman), in submitting the accounts, said that the statements submitted showed a continuation of the progress which had characterised the company's undertaking since the effects of the boycott of 1927 began to pass away. The number of car miles run and the passengers carried was greater than ever before, and so far as the current year was concerned the same tendency was evident, although he did not mean to suggest that for the current year the same ratio of advance would be maintained, because during the year under review, the fleet of vehicles was substantially augmented from time to time, but the additions now being made were not on so large a scale. They could not, moreover, escape the adverse effect of the prevailing depression in the markets for rubber and tin, which was bound to affect the prosperity of Singapore, and reduce the spending power of the population. The report and accounts were adopted.

Yorkshire Electric Power Co.

The accounts for the year ended December 31st last show a net profit of £341,084, as against £310,070 in 1928, to which is added £78,233 brought forward, making £419,317. The directors recommend a final dividend of 3 per cent. on the cumulative preference shares (making 6 per cent. for the year), and a final dividend of 5 per cent. on the ordinary capital (making 8 per cent.), leaving £181,413, of which £100,000 is placed to reserve and £81,413 carried forward. The year's trading showed a continued growth in the demand for electricity. Large extensions of mains and sub-stations have been made, extending into Derbyshire and Lincolnshire, to supply Gainsborough Urban District Council with electricity in bulk. Under the Mid-East England Electricity Scheme, the company's three stations have been determined to be "selected" stations. The applications for powers to supply electricity in certain parts of Lincolnshire and the East Riding, which the Electricity Commissioners have intimated their intention to grant, are proceeding; the details are still under discussion.

Bristol Tramways and Carriage Co., Ltd.

The accounts for the year ended December 31st last show a total revenue of £1,199,554 and a net revenue (including £3,786 brought forward) of £167,352, against £188,185 for 1928. After meeting debenture interest, &c., and preference dividend, it is proposed to pay a final dividend of 6 per cent. on the ordinary shares, making 10 per cent. for the year (against 7 per cent.); to transfer £10,000 to reserve for contingencies and renewals (against £15,000); and to carry forward £4,278. With the amount now allocated, the reserve fund stands at £433,002. The Bristol Corporation did not exercise its option to purchase the tramway undertaking during the year and the option does not recur for a further period of seven years. Meeting: February 18th.

London Power Co., Ltd.

Speaking at the annual meeting on February 7th, the chairman (Mr. W. F. Fladgate, M.V.O.) said that the capital expenditure during the year had amounted to £1,586,000, the bulk of which was in respect of the Deptford West station, which had been put into operation and had been found to be most economical in working. The output for the year was about 733 million kWh, representing an increase of 23.46 per cent. That total was exceeded only by the North-East Coast group of companies. The operating cost per kWh had been reduced from 0.278d. to 0.240d.; taking 1924 as a datum, that

represented an actual money saving of £675,000. The Horseferry Road control room, which enabled the staff there to control the whole of the company's stations, had been completed. With regard to the Battersea station, progress had been made with the foundations and river work. Efforts were being made during the current year to expedite the work. It was their aim to make the new station the last word in efficiency, as it would form one of the most important links in the chain of stations in Southern England. The station would be a notable addition to the buildings on the banks of the river; Sir Gilbert Scott's services had been enlisted in its design. The report and accounts were adopted.

Tyneside Tramways and Tramroads Co.

The report for the half-year ended December 31st last shows that the expenses exceeded the receipts by £209, and after providing for interest on mortgages, &c., the total deficit is £1,784. Against this are set a balance of £69, brought forward, and £1,800 from the general reserve, leaving £85 to be carried forward. The traffic receipts for the whole year showed a decrease of £1,912, the number of passengers carried falling from 6,615,216 to 6,225,262. The Bill for powers to abandon the tramways and to run omnibuses received Royal Assent in December last, and the holders of the mortgages and shares have passed resolutions providing that prior mortgages to an amount not exceeding £26,370 shall be created. It is proposed to issue in the first instance not more than £18,000 of these prior mortgages.

St. James' and Pall Mall Electric Light Co., Ltd.

The report for 1929 shows a net profit of £75,339, to which is added £112,377 brought forward, making £187,716 available. The directors propose to pay a final dividend of 8.4d. per share on the preference shares, making 7 per cent. for the year, and a final dividend of 9.949d. per share on the ordinary shares, making 1s. 6.949d. per share for the year. An amount of £22,361 is transferred to special reserve, £4,993 is appropriated to co-partners, and £100,462 is carried forward. The report records the death of Mr. R. H. Benson, a member of the board. Meeting: February 25th.

Electrical and Industrial Investment Co., Ltd.

The profit for 1929 was £23,797, as against £22,148 in 1928. A preference dividend of 6 per cent absorbs £6,000, preferred 7 per cent. takes £7,000, and deferred 7 per cent. £7,000, leaving £3,797 carried forward. The unissued 10,000 deferred shares of £1 each were subscribed at par and deferred ordinary shares were converted into deferred ordinary stock. The credit balance resulting from changes of investments has been placed to reserve, making that account £71,363.

Pennsylvania Water and Power Co.

The total revenue for 1929 was $4,755,757, and the net revenue $2,229,480. A final quarterly dividend of 75 cents is proposed (previous three quarters 62½ cents), $352,101 is placed to reserve, $100,000 to sinking fund, and $120,000 to miscellaneous reserves, leaving a balance to surplus of $529,030.

Westinghouse Brake and Saxby Signal Co.

The accounts for the year ended September 30th last, show a profit of £115,519 (including £13,227 brought forward), an amount of £30,000 is placed to reserves, and the directors recommend a dividend of 8 per cent. (less tax at 3s. 10½d.), against 10 per cent. (less tax), carrying forward £13,033.

Power Securities Corporation, Ltd.

The accounts for 1929 record a gross income of £112,392, and after paying all expenses there is available a balance of £79,424, to which is added £14,869 brought forward. Reserve account receives £20,000, and the directors propose to pay a dividend on the ordinary shares for the year at the rate of 7 per cent., less tax, leaving £18,294 to be carried forward.

Fife Electric Power Co.

The company has asked the Secretary for Scotland to make a Provisional Order empowering it to raise its authorised capital from £600,000 to £1,000,000, and to divide its existing £10 shares into ordinary shares of £1 denomination. Power is also sought to raise £500,000 by the issue of debenture stock.

Cables and Wireless, Ltd.

The company has sent the following reply to inquiries which have been received from stockholders:—"It has already been announced that it is not possible for Cables and Wireless, Ltd., to publish its audited balance sheets and revenue accounts to December 31st in each year until about the following Midsummer, owing to the time which must elapse before it can get in the accounts to the close of the year from its branches and subsidiary companies all over the world. The directors cannot give individual stockholders information which they do not give to the general body of stockholders, whilst to publish any anticipation of results based on incomplete data would be undesirable." The statement is signed by Mr. Edward Wilshaw, the general manager and secretary.

Shawinigan Water & Power Co.

A dividend of $¾ per share has been declared on the common shares for the quarter ending March 31st next.

Stocks and Shares.

TUESDAY EVENING.

STOCK Exchange markets derived benefit from the reduction in the Bank Rate last week to 4½ per cent. This was accepted as an indication that the Bank of England and the Government see their way to the likelihood of money conditions remaining easy for some time to come. The immediate effect of the news was somewhat disappointing, in that business was not stimulated to any marked extent: there was, indeed, more tone than trade. Promptly on the heels of the announcement came the news of several substantial new issues, and, according to report, there are many other companies, municipalities, and governments which require more money, and are only waiting for a favourable opportunity in order to make their appeals to the public.

New Issues.

These considerations have the effect of holding back prices of existing stocks, though in the cases of the recently-offered electricity issues—that is, the Central Electricity fives and the North-West Midland fives, moderate recoveries occurred. The price of the former improved to 1 discount on the issue price of 97½, while North-West Midlands Joint Electricity Authority 5 per cent. scrip strengthened to 1½ discount on the issue price of 98½. On the latter stock there is a first interest payment of £1 15s. per cent., due on July 1st next, while Central Electricity scrip receives a full half-year's interest payment of 2½ per cent. on September 1st this year.

London Power 5 per cent. debenture stock changes hands daily on the basis of 99½, which includes the six months' interest payment due next month. At the meeting the other day, Mr. Fladgate, the chairman, mentioned that the company is precluded by its constitution from making profit, its main purpose being a lowering of costs. In this latter respect, the London Power Company can claim success, the average price per unit having fallen by .38 of a penny during the twelve months under review. He stated that the proposed Battersea station will form a striking architectural feature of the Metropolis, and that it will also be the last word in efficiency. The net revenue, for 1929, as shown last week (p. 265), came to £866,373, an increase of £182,000 over that of 1928.

Electric Railway Stocks.

The Underground Electric Railways of London and the Associated Companies declare their dividends on the Thursday in this week. Lively interest is taken in what the District and the Underground Companies are likely to pay. The first effect of the increased dividend on Metropolitan consolidated stock was to put back the price to 63¾, but it rallied to 64½, at which the yield on the money, it will be noticed, comes to about 6¼ per cent. which is quite a good return from an investment of this nature, having regard to the prospects of improvement in the future. Districts are steady at 74½; Underground Electric income bonds have risen to 109, after being down to 107. London Electric ordinary stock is better at 73½. The feature in the railway world during the current twelve months will be, it is safe to say, the extension of tube railways, more particularly, perhaps, in the northern and eastern suburbs of London. The schemes under consideration, of which those of the London & North-Eastern Railway were mentioned here last week, will call for the provision of very considerable sums of money. It is considered probable that, in view of the amount of employment which these railway-building plans will give, the Government may assist in the financing of the tubes' construction. At all events, there seems to be no doubt that suppliers of electrical equipment, &c., will be kept fully employed with work for the next two or three years, and, on this view, prices of shares in the group of companies that deal with electrical manufacturing and equipment are maintained at levels which look high, in relation to the yields which the investments offer.

London and Suburban Traction preference rose 1s. 6d. to 12s., reacting to 11s. 6d., which leaves a rise of 1s. The ordinary shares hardened to 3s. 6d.

Manufacturing Companies' Shares.

The G.E.C. ordinary have stiffened to 47s. 6d., and the firmness shown by other shares in this group is well maintained. Telegraph Constructions, for instance, hold their big rise, having changed hands at £27. The effect of the English Electric reconstruction scheme has been to depress the price of the ordinary to 3s. 9d., though the preference remain in the neighbourhood of 7s. 6d. It is pointed out that if the scheme goes through, the sum of £750,000 will be supplied for the purposes of the company's business, and the control will pass into the hands that put up the money. No little curiosity is felt as to the nationality of the people ready to pay this amount. Electric Construction shares, the Stock Exchange official quotation for which is 15s., changed hands on Tuesday this week at 12s. 5½d. Associated Electric ordinary at 27s. 6d. have recovered their recent small loss. Callender's 6½ per cent. preference shares, which seldom come to market, have been on offer, and the price weakened to 23s. 9d. The yield at this price is about 5½ per cent. on the money, which is reasonable, in view of the character of the security offered by the shares, and of the lowering of the Bank Rate last week. Crompton Parkinson ordinary are 9d. better at 21s. 6d. Cable construction issues have changed but little.

Iron, Steel, and Engineering.

Amongst the shares of iron, steel and kindred undertakings, Babcock & Wilcox have strengthened to £3. On the other hand, Vickers are a dull market at 8s. sellers. Great uncertainty prevails in connection with the Government's anticipated plans, as likely to be shown in the Budget, with regard to the Safeguarding of Industries duties. Mr. Baldwin's recent speech was expected to clear up the doubts which prevailed in regard to the Unionist Party's programme on this head, but the previous Prime Minister failed to dispel the obscurities which persist, not only with respect to the intentions of the present Government, but to those which regulate the policy of the Opposition. A flash of interest illuminated the rubber share market, on an extremely moderate rise in the price of the product, as quickly lost as it was gained.

Home Electricity Supply.

Further improvement in Metropolitan Electric ordinary shares served to bring the price to within a shilling or so of the level £2, and the new have strengthened simultaneously to 37s., which is 7s. premium upon the issue price. The new County of London ordinary are a shade easier at 6s. 4½d. premium, the senior issue retaining their quotation of 45s. 9d. Clyde Valleys are a little lower at 35s. 9d. The Yorkshire Electric Power Company's report is very interesting, as reflecting, to some extent, the industrial conditions prevailing over the wide area in which the company works. The ordinary dividend is maintained at the 8 per cent., which has been the annual rate distributed for the past eleven years, but in view of the extra capital raised not long ago, the present payment absorbs £32,000 more than that of last February. The report testifies to the progressive character of the management, and also to the scope that exists for electrical development in this country. The price of the shares is unchanged at 32s. 6d., at which the return on the money comes to about 5 per cent., allowing for the accrued dividend now included in the quotation. Egham and Staines continue dull at 31s. Richmond (Surrey) are unchanged at £2 2s., and Isle of Thanet ordinary at 31s. 9d. show a gain of the pence. The Shropshire, Worcestershire, and Staffordshire Electric Power 6 per cent. preference shares, to which reference was made here last week, as being on offer at 22s. free of stamp and fee, are now obtainable at a shade less. Notting Hill Electric 4 per cent. debenture stock has gained 3 points at 95, and a rise of 2 points to the same figure has occurred in the portentously-named Kensington and Knightsbridge Electricity Company and the Notting Hill Electric Lighting Company 4 per cent. debenture stock.

Miscellaneous Movements.

Madras Electric Supply 5½ per cent. preference strengthened to 20s. 9d., thanks to the more cheerful view which has been taken of Indian investments as a whole. Perak River Hydro-Electric shares weakened to half-a-guinea. Fife Tramways preference at 16s. 3d. are a shilling harder. At the meeting of Hall's Telephone Accessories early this week, the proprietors unanimously agreed to increase the capital, and, as already mentioned, one new share at 11s. is to be allotted to proprietors in respect of every eight old shares held.

Dollar Stocks.

Montreal Light and Power shares at 142½ are 4 points higher, having been down to 136 during the week. The Shawinigan Water & Power Company, in its report for last year, records net earnings of $5,900,000, an increase of rather over $1,000,000 for the year. The price of the shares, at 81, is unchanged on the week. The Pennsylvania Water & Power Company announces net earnings of $2,229,500, showing an increase of $200,000 over 1928, and the price of the shares has risen 10 points to 87½. Business in the shares is so infrequent on this side that no bargains are recorded in the Stock Exchange Official List between one (at 75) on January 7th up to the present time. Hydro-Electrics are lower at 42½. Brazilian Tractions at 39 are ex half a dollar dividend, the preference shares being quoted at 135. American Telephone and Telegraph are 235, and International Telephone and Telegraph remain at 73.

Cables and Wireless.

In response to many requests for information on the part of Cables and Wireless stockholders, rendered anxious by the falls in the "A" and "B" stocks, the directors have issued a statement which tells practically nothing of any value, and leaves proprietors as much in the dark as they were before. The directors dilate upon the reasons for the delay that will prevent publication of the accounts before midsummer, and they say it would be undesirable to publish anticipations, upon incomplete data, of the 1929 results. The "A" stock, after a momentary dip to 60, has recovered to 64¼. The "B" fell to 28 before rallying to 30½, and the 5½ per cent. preference stock is unaltered at 96. Globe Telegraph and Trust ordinary have gone back another 10s., to 23½. In the wireless group, Marconi Marines fell 1/16 to 2 3/16, apparently on fears of possible competition. Canadian Marconis are 15s. 9d. West India and Panama Telegraphs changed hands a few days ago at 1s., and, on the same day, business was marked at 5s. in the preference shares. Venezuela Telephones are a shade better at 24s. 6d., the "A" ordinary being quoted at 20s. 6d.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price Feb. 11 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	3⅞x	—	4 18 0
Brompton Ordinary	1	8½	8½	25/6	—	5 9 10
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/-xd	+5d.	5 6 0
Chelsea	1	8¾	8¾	25/-	—	5 12 0
City of London	1	10	10	33/-	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	35/9	—6d.	4 8 8
County of London	1	7	10	45/9	—	4 7 4
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	47/-	—	4 13 7
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	27/-	—6d.	5 11 1
London Electric	1	8½	9	26/6		5 5 8
Metropolitan	1	9	9	38/9	+6d.	4 13 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 6
Midland Counties	1	6½	6½	28/-	—	4 12 10
Mid. Elec. Power	1	15	8	38/9	—	4 14 10
Newcastle-on-Tyne Ordinary ...	1	6	6	28/9	—	5 1 1
do. 7% Pref.	1	7	7	25/6	—	5 9 10
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 4
North Met. Elec. 6% Pref. ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	1	8	8	25/6	—	5 9 10
Scottish Power	1	8	8	30/-	—	5 6 8
South London	1	8½	8½	26/6	+6d.	5 4 10
Urban Ordinary	1	7	7	33/9	—	4 5 2
Westminster Ordinary	1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	32/6	—	4 18 6

Home Rails.

Central London Ord. Assented ...	Stock	4	4	73	—	5 11 1
Metropolitan	„	3	3½	64½	+½	6 4 0
do. District	„	4	5	74½	—	6 15 2
Underground Electric	£1	5	7	23/-	—	6 1 9
do. do. Income ...	Bonds	6	6	109	+1	5 12 1

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
do. Def.	„	1½	1½	24	—	6 5 0
Automatic Telephone	1	10	12½	87/6	—	6 18 4
Cables & Wireless 5½ Pref.	Stock	—	—	96	—	5 14 8
do. A 7½ Ord.	„	—	—	64½	+1	... ...
do. B Ord.	„	—	—	30½	—	... ...
Globe Tel. and T. Ord.	10	10	10	23	−½	*4 7 0
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	20	20	31	—	6 9 0
Marconi-Marine	1	19½	15	2 3/16	−1/16	... ...
Oriental Telephone Ord.	1	12	12	21 3/16	—	*4 5 5

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8 1/16	—	8 19 6
do. do. 2nd Pref. ...	5	6	6	3 1/16	—	9 16 0
do. do. 5% Deb. ...	Stock	5	5	78½	−1	6 16 1
British Electric Traction Def. Ord.	„	5	5	15/6	−50	... ...
do. do. Pref. Ord.	„	8	8	124½	—	6 8 6
Brazil Traction	100	7	8	39xd	−8/4	5 2 7
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	90½	+1	5 10 6
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	11/6	+1/-	... ...
London United Tram Deb. ...	Stock	4	4	50½	—	7 18 0
Mexico Trams, 5% Bonds	—	5	5	65¾	+3	7 12 8
Mexican Light Common	100	Nil	Nil	7⅞	−3/8	... ...
do. 7% Pref.	100	7	7	7¾	+1	9 18 2
do. 1st Bonds	—	5	5	72½	—	6 18 0
Victoria Falls Ord.	1	15	15	3	—	5 0 0
Yorkshire (West Riding)		Nil	Nil	6/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	—	27/6	+1/-	4 7 3
Babcock & Wilcox	1	18	15	60/-	+6d.	*5 0 0
British Aluminium Ord.	1	10	10	44/6	—	*4 7 4
British Elec. Transformer Pref. ...	1	7	7	10/-	—	... ...
British Insulated Ord.	1	15	15	8¼	—	9 17 4
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	1	15	15	8½	—	4 1 1
do. 6½% Pref.	1	6½	6½	23/9	−1/-	5 9 5
Crompton Parkinson Ord.	5/-	—	20	31/	+9d.	6 19 6
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 9
do. 6% Deb.	Stock	6	6	84½	—	5 18 4
Electric Construction	1	7½	6½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4⅝	—	4 6 5
English Electric	1	Nil	Nil	8/9	−1/8	... ...
do. do. Pref. ...	1	8	Nil	7/6	—	... ...
Gen. Elec. Pref.	1	6¾	6¾	24/-	—	5 8 4
do. Ord.	1	10	10	2⅝	+1/8	4 4 2
Henley...	1	25	20	6 1/16	—	4 18 8
do. 4½% Pref.	6	4½	4½	4⅝	—	5 5 0
India-Rubber	1	Nil	Nil	11/8	—	... ...
Johnson & Phillips	1	10	—	36/3	—	5 10 3
Siemens Ord.	1	7½	7½	25/-	—	6 0 0
Telegraph Construction	12	10	10	27	—	*4 9 0

*Dividends paid free of Income Tax.

The British Industries Fair.—I.

Some Notes on the Exhibits, Visits, and Functions at London and Birmingham.

THE biggest trade event of the year—the British Industries Fair—commences on Monday next, the 17th, at Castle Bromwich, Birmingham, and Olympia, London. The opening of the Fair will be celebrated by a Government banquet at the Mansion House at which the Duke of York will be the principal speaker. Mr. Arthur Henderson, the Foreign Secretary, will preside.

Testimony to the fact that interest in this annual display is maintained at a high level is provided by the reappearance of practically all of the regular exhibitors with many newcomers.

So far as the Birmingham section is concerned (and that is the section with which we are principally concerned), the Fair is the eleventh of the series. During the past decade the aerodrome buildings at Castle Bromwich have been considerably extended year by year until now there is a floor area of over eleven acres under one roof. The buildings are about a third of a mile long and 250 ft. wide. For its work in bringing the Fair to such an excellent position the Birmingham Chamber of Commerce (which is responsible for the organisation of the Section) deserves the thanks of British industry.

The Electrical Exhibitors.

In the same way the Electrical Advisory Committee, of which Mr. T. R. Martin is chairman and Mr. E. J. Jennings secretary, is entitled to the gratitude of British electrical manufacturers for the way in which it has fostered and built up the now important Electrical Section of the Birmingham display.

Prior to 1926 the electrical exhibitors were few, and literally far between, for they were scattered all over the great building, and most of them were only showing electrical goods as side lines. Now no fewer than 150 firms are showing products of an electrical or allied nature, and the majority of them are to be found in Blocks 15 to 21—formerly Buildings "B" and "C."

Our own stand is No. 4 in Block 21 "F." There, as we informed readers last week, we shall have a staff ready to give whatever assistance it can to inquirers—to answer questions, to deliver messages, to type correspondence, and, in short, to perform a number of services to help make a visit trouble-less and pleasant, as well as to assist manufacturers and their representatives in the pursuit of business. The stand will be readily identified by its large electric sign, which we hope will attract readers, whether buyers or sellers, to make a call on us. So much for Birmingham.

This year the New Empire Hall, Olympia, houses the London Section of the Fair. The building is the last word in modernity and the arrangements are much in advance of those of preceding years. A brief description of the new building appeared in our issue of January 31st (p. 217). At Olympia there will also be found a number of electrical exhibitors, but their displays will, in general, be of the lighter classes, with radio apparatus predominant. We gave a list of them in our issue of January 10th (p. 81). At the same time we published a list of exhibitors at Birmingham additional to that which appeared in the preceding issue (p. 15).

Visits and Conferences.

In our January 3rd issue, too, we set forth a list of official visits and luncheons in which the leading electrical organisations are participating. There are two principal electrical days at Birmingham: Thursday next, February 20th, and Thursday, February 27th. The first is mainly professional in character, and a notable feature will be a conference arranged by the British Electrical Development Association. The associations represented will include the I.E.E., the I.M.E.A., and power company and tramway associations. The trading side of the industry will gather at the Fair on the 27th, when the Electrical Contractors' Association, the Electrical Wholesalers' Federation, the Electrical Merchants' and Manufacturers' Association and other bodies will be represented. The contractors and wholesalers are to hold a conference in the morning.

On the first electrical day, Mr. T. R. Martin, of the Fair Management Committee, will preside at the luncheon and will propose the toast of "The Electrical Industry." The responders to the toast will be Lt.-Col. K. Edgcumbe, past-president of the I.E.E., and Alderman W. Walker, M.I.E.E., of the Central Electricity Board. At the luncheon on February 27th, the toast of "The Electrical Industry" will be acknowledged by Sir John R. Brooke, C.B., Electricity Commissioner, and Mr. J. K. Brydges, president of the I.M.E.A.

Every day of the Fair there will be official visits by trade and professional associations and these should unquestionably be of great value to the electrical exhibitors. For instance, there will no doubt be many potential buyers among the delegates attending on February 26th when the bodies represented will include the Association of British Chambers of Commerce, and the London Export Merchants, as well as hardware trade organisations.

An Electric Restaurant.

In the earlier years the facilities afforded to exhibitors and visitors were of a rather primitive character and complaints were numerous. Now, however, the arrangements have been brought more up-to-date. The train service is supplemented by Corporation motor 'buses specially provided for the purpose of conveying visitors from Birmingham to the Fair and back. A conference hall of considerable dimensions is now available and the catering arrangements have been vastly improved. This year the Heating and Cooking Section of B.E.A.M.A. has arranged a co-operative "display" by its members in the form of a large electric kitchen representing a load of something like 150 kW. The principal appliance is a roasting oven capable of dealing with from 250 to 300 lb. of meat at a time and rated at 14 kW. Then there is a 12-kW cabinet roasting oven with a cooking space four feet in height and two feet square. It is built of sheet steel, double cased and lagged. Two steaming ovens have been installed for cooking fish and vegetables; each of them has a loading of 5 kW. Another large appliance is a boiling table in which a number of plates are fitted, the whole being rated at 27 kW. The other equipment includes a double-oven cooker, two hot cupboards (3½ and 6 kW), and a 12-kW and an 8-kW bain maries. The newly-electrified restaurant is capable of providing luncheons for 1,000 and teas for 2,000 people daily. There is also an impressive display of cooker control gear. The supply for the kitchen is dealt with by a 150-kW, 440-V, 3-phase, 4-wire transformer, and the apparatus is balanced on the phases, the boiling table being wired three-phase.

To do justice to the exhibits we are compelled to publish descriptions of them over several issues. Below we give the first instalment of notes on the stands at Birmingham. The remainder and those at Olympia will be dealt with subsequently.

Our notes on the various stands will show that a very comprehensive display has been arranged by the electrical and allied manufacturers—ranging from large oil-engine driven generators down to washers and small insulators. We think it is safe to say that no department of the electrical industry is entirely unrepresented.

Some of the Exhibits.

A First Instalment of Illustrated Notes.

Troughton & Young, Ltd.

This company is among the pioneers of modern decorative electric lighting and some excellent examples of its design and workmanship can be seen installed on the ELECTRICAL REVIEW stand. As will be seen from the illustrations in fig. 1, the design of the fittings is based on the straightforward use of special tubular lamps with opal coverings. The lines of the lamps make an interesting arrangement, the decorative value being obtained without the use of a great deal of superfluous ornament. The metalwork is brass finished with chemical green bronze, coloured by a special process, and the arms are silver-plated. In the case of the four-light

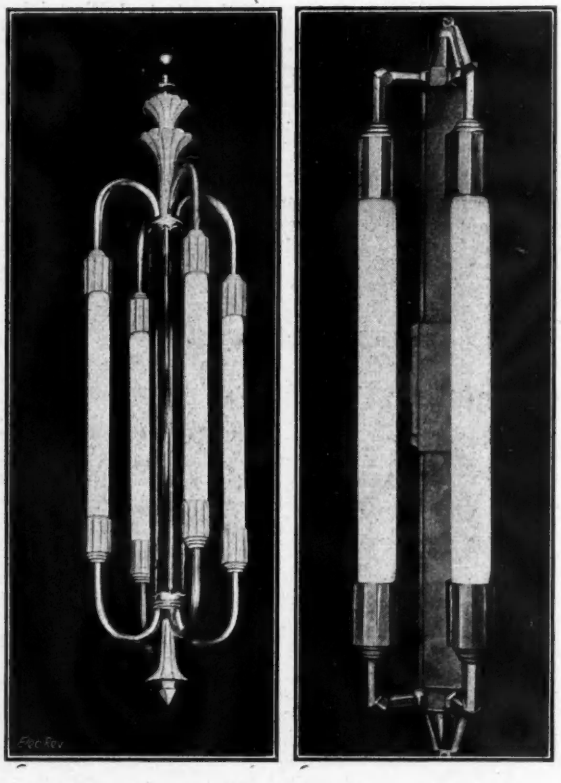


Fig. 1.—Lighting Fittings on the "Electrical Review" Stand.

pendant the centre tube is of glass with the inside black mirrored. In every case the lamps are removable by the unscrewing of the green bronze metal caps.

General Electric Co., Ltd.

The stand of this company is divided into three sections, the centre section taking the form of a lounge, and the end sections being assigned to electric furnaces in operation. In the lounge the illumination includes floor standards and a special centre fitting representative of the company's products. The "Magnet" electric furnaces shown include examples suitable for annealing, hardening, tempering, case hardening, and normalising steel for the annealing, normalising, and heat-treatment of brass, copper, aluminium, and other non-ferrous metals and alloys. These furaces are heated by means of large diameter nickel chromium wire heating elements arranged along the sides and under the hearthplate of the heating chamber. The elements are supported in special heat resisting panels and can easily be replaced if necessary. Cast nickel chromium element guards are fitted. The door-lifting mechanism, which can be arranged on either side of the furnace, is very light in operation as the door is accurately counterweighted. A switch is arranged to cut off the furnace current automatically when the door is opened. Terminal bars of adequate section to prevent overheating project through the back wall into a terminal box, which also accommodates a gold excess temperature fuse. A pyrometer can also be

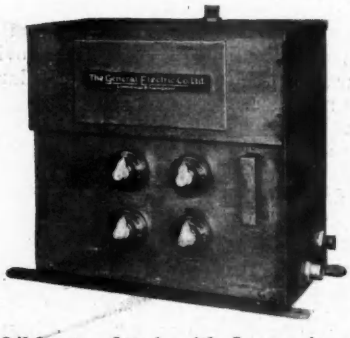


Fig. 2.—Oil-heater fitted with Immersion Heaters.

placed within it. The shells are of steel plate reinforced with angles and bolted together, making a rigid construction, and the legs, which are detachable, are of heavy cast iron bolted to the body of the furnace. Important features of these furnaces are that the elements are so distributed as to ensure uniform temperature in all parts of the furnace interior, and that the employment of resistor elements constitutes a unity power factor load which usually serves to improve the power factor conditions in the whole plant in which they are installed. These furnaces, which have a maximum working temperature of 1,000 deg. C. (1,830 deg. F.), can be arranged for any standard voltage, either d.c. or a.c. of any periodicity, and can be fitted with automatic temperature control gear mounted alongside and sway-bar door operated mechanism as illustrated in fig. 3. They are made in standard sizes of 30 kW and 80 kW. Another type of furnace shown is the "Magnet"

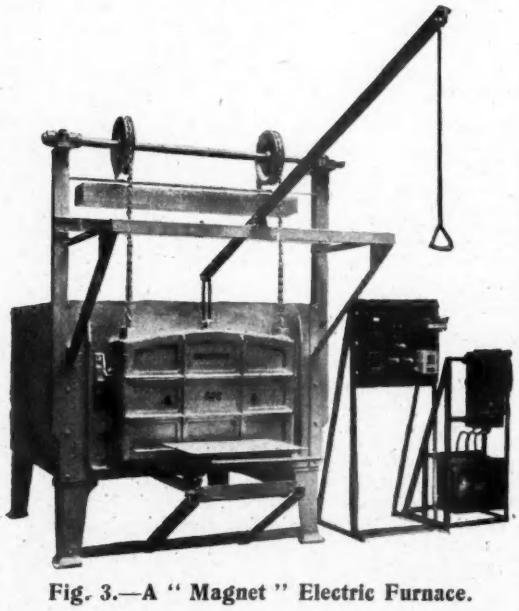


Fig. 3.—A "Magnet" Electric Furnace.

stand muffle type furnace of 8-kW capacity, suitable for a maximum working temperature of 1,000 deg. C. (1,830 deg. F.). In this case the muffle is of refractory fireclay wound with nickel chromium wire so arranged as to give an even temperature throughout the length of the muffle. Other exhibits include an oil-heater fitted with special electric immersion heaters (fig. 2) and a small lead melting pot.

Credenda Conduits Co., Ltd.

A wide range of "Creda" electric cookers, similar to those hired by a large number of supply authorities, are shown on the stand of this company. These are exhibited in two finishes, *viz.*, "Standard" and "De Luxe." An interesting addition to this year's display is the new "Creda Cub" cooker. This has an oven with internal dimensions of 12 in. by 12 in. by 12 in. and the hob, which, like the oven, is finished in vitreous enamel, has an enclosed grill-boiling plate 8 in by 6 in. (1,500 watts), and a "Sadia" boiling plate 8 in .by 6 in. (1,600 watts). The cooker illustrated (fig. 4) has a de luxe finish. Examples of hotel and restaurant cooking apparatus

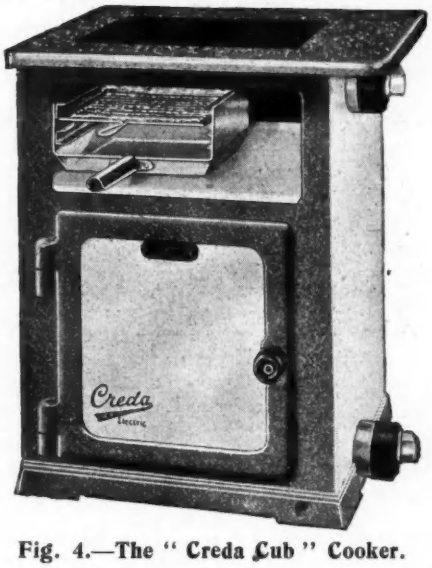


Fig. 4.—The "Creda Cub" Cooker.

are also shown, which include a double compartment grill on stand, a hot cupboard, double oven range, &c. A full range of automatic water heaters are also shown, with wash boilers, the "Creda" tubular heating system, and some examples of the company's extensive range of electric fires, of which it manufactures over 100 different models. Many other appliances are exhibited, including kettles, irons, toasters, &c., also "Credalux" industrial lighting reflectors and street lighting fittings, for which, the company states, extra plant has been laid down and special arrangements made to cope with the rapidly growing demand.

British Thomson-Houston Co., Ltd.

On the stand of this company many exhibits are in operation, particularly motors and control gear for industrial service, comprising in the main standard forms for a.c. and d.c. circuits, the sizes on view including fractional h.p. and larger ratings, as well as the newer "built-in" motors, and

Fig. 5.—A Horizontal Worm-geared Unit.

worm-geared motor units. For use on single-phase a.c. circuits there is also a repulsion induction motor, which is designed to start up easily under heavy load and to run at high power factor.

One of the most recent developments of the company is the introduction of "built-in" motors for giving direct drive to machine tools and woodworking machinery. The stator unit consists of a core and winding in an enclosing shell, and the rotor unit a squirrel-cage rotor with centrifugally cast aluminium bars and end rings. The units are assembled by the machine tool makers, and housed in frames which are designed as an integral part of the machine tool, and the machine tool makers also provide shaft, endshields and bearings as part of their design.

A new line of worm-geared motor units is also represented. These units, with the motor mounted integral with a worm reducing gear, are shown in two forms—vertical and horizontal (fig. 5)—from 7.5 to 1, to 30 to 1. These geared units give high efficiencies over a wide range of ratios; ratios are standardised, but greater reductions can also be supplied.

Various motor starters and controllers for both a.c. and d.c. reversing and non-reversing motors are also shown. These equipments range from examples of control pillars for large motors to motors of fractional h.p. rating in forms for either wall or floor mounting. An improved type of oil-immersed a.c. control panel is the ATM, form T (fig. 6), which is being shown for the first time. This is designed for starting and protecting 3-phase slip-ring induction motors up to 15/20 h.p. at any voltage up to 550 at 25 and 40/50 cycles, maximum stator current 30 amperes, including the B.E.S.A. overloads, and rotor current not exceeding 75 amperes. Push-button control is provided for. The thermal type oil-immersed motor starter and circuit breaker has been developed for the direct-

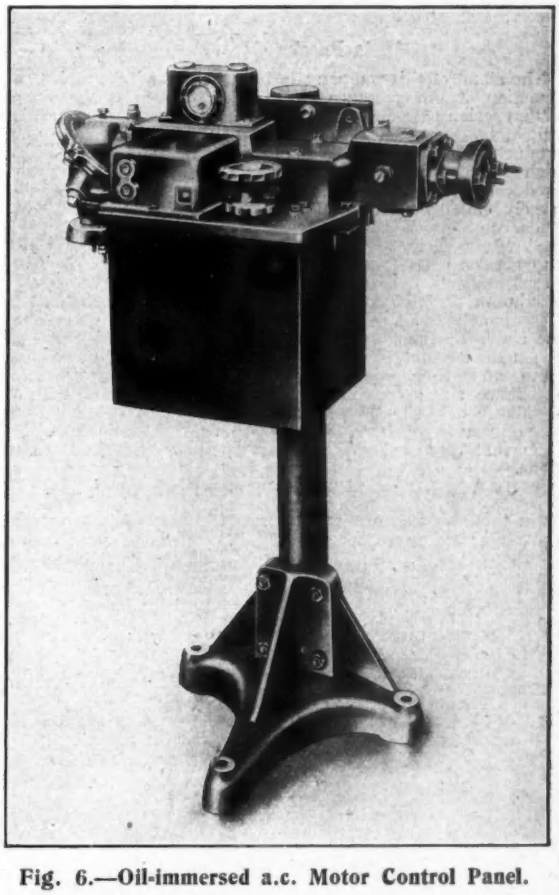


Fig. 6.—Oil-immersed a.c. Motor Control Panel.

starting of squirrel-cage motors taking current up to 30 amps. on voltages up to 660, and giving protection against every kind of fault on all phases. This starter measures only 8¾ in. high, 7⅞ in. deep, by 6 in. wide, has a dust and drip-proof enclosure and is under push-button control, either local or remote. A typical totally-enclosed a.c. pillar type contactor starting equipment is also shown, suitable for controlling a non-reversing 25-h.p. slip-ring induction motor against twice full-load torque with remote push-button control.

The metal-clad, vertical plugging switchgear, class "Z," is again shown. This gear comprises bus-bars completely shut off from the other chambers, and oil-circuit breakers plugged into contact socket holes and removable by displacing the breakers vertically downwards, this method effecting substantial economies in space compared with the draw-out truck type switchgear. Guide holes are provided in the frame to accommodate locating spears carried by the oil-circuit breaker, ensuring that the breaker is lifted into position in correct alignment. An automatic shutter closes the contact socket holes when the breaker is withdrawn. Amongst other switchgear equipments is the ironclad, oil-immersed circuit-breaker, type "OZ," suitable for operating on 3-phase circuits not exceeding 660 V. The effectiveness of the stand is enhanced

by an illuminated model after the picture "Beauty Enriched by Light," now to be seen all over the country, focusing attention on pearl "Mazda" lamps, and other lamp displays.

Stuart Turner, Ltd.

Various designs of small lighting and pumping plants are shown by this company. The 250-watt bungalow lighting set is of extremely small dimensions, enabling it to be accommodated in the minimum space, while for farms and country house lighting 500 and 750-watt plants are shown. In all cases switchboards are mounted on the plants so that the installation costs are reduced to a minimum. These plants have been produced to meet the demand both at home and abroad for plants capable of giving long service without skilled attention. Ball and roller bearings are provided throughout and as these engines are of the two-stroke type there are no valves or valve gear to require attention. The 500 and 750-watt plants have a pulley enabling other machinery to be driven from the engine.

The Stuart pumping plant consists of a 1-h.p. engine direct-coupled to a vertical double-ram pump with an output of about 800 g.p.h. and 100 ft. head. This plant is a suitable one for providing water supply for a country house, estate or farm.

Horstmann Gear Co., Ltd.

Among this company's exhibits is a representative range of "Newbridge" time switches; models for street lighting, shop-window lighting, two-rate meter control, &c., will be on view. "Newbridge" time switches are made at the company's works at Bath, save the Swiss escapement, and are available in capacities from 1.5 to 50A.

Gutta-Percha Company.

The stand of this company (a branch of the Telegraph Construction & Maintenance Co., Ltd.) again displays alloys with specialised magnetic and electrical resistance qualities, which, however, have been improved in quality on last year's products. Included in the magnetic alloys is "Mumetal," a high permeability, low hysteresis alloy, which was primarily produced for continuous submarine cable loading, but is now largely employed for improved current transformers, and finds considerable application in the radio industry. It is available as bright rolled strip in all standard thicknesses, and also as ring stampings. Test samples of this alloy have been produced with an initial permeability of 19,000 and a maximum of 130,000. Another magnetic alloy exhibited is "Radiometal," an alloy which is finding general acceptance for audio-frequency transformer coils, owing to its high and constant incremental permeability. This is shown in standard strip and sheet sizes, and as stampings. The electrical resistance alloys include "Pyromic" high resistivity, heat-resistance alloys. "Pyromic" No. 1 is characterised by a strength at high temperatures two or three times greater than that of nickel-chromium alloys under the same conditions.

Wild-Barfield Electric Furnaces, Ltd.

On this stand an automatic hardening furnace is shown in operation, having an output of 68 lb. of steel per hour with a loading 7.8 kW. A larger furnace (fig. 7) with maximum

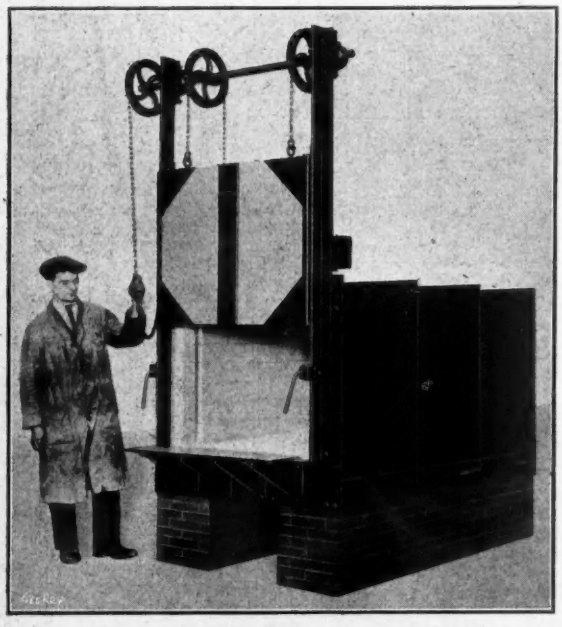


Fig. 7.—A Wild-Barfield Electric Furnace.

loading of 20 kW, controlled by means of an automatic recording controller, is used for enamelling signs by the Imperial Enamel Co., Ltd. The control equipment comprises a strip recorder with a temperature range of 0-1,000 deg. C., having a chart sufficient for 30 days. A time switch is mounted on the panel, and this can be employed to switch the furnace on before the works open in the morning, or to switch off at night without attendance. The labour costs are thus reduced to a minimum. Furthermore, the pyrometer leaves a permanent record on the chart of the maximum and minimum temperatures to which the furnace has been subjected. This enables the executive to ascertain that the temperatures set for various operations have been faithfully carried out by the operative. An electric high-speed steel-hardening furnace will also be in operation. This has a

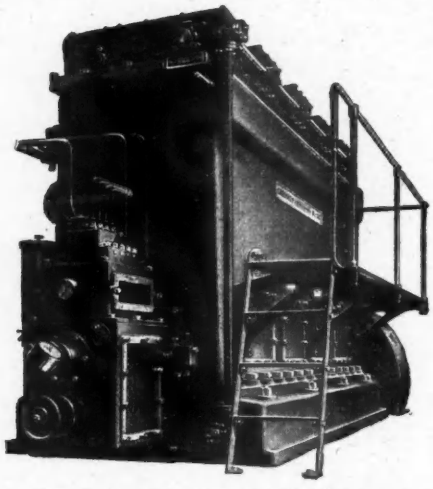


Fig. 8.—A Crossley Vertical Diesel Engine.

chamber measuring 8 in. by 6 in. by 3 in., which operates up to 1,350 deg. C., and the complete equipment includes a preheating and tempering chamber, two separate controlling rheostats, one of which embodies the Wild-Barfield patent ballast, which obviates the negative temperature co-efficient, and consequent disadvantages usually associated with heaters of the carborundum type. This furnace, which can equally well be fitted with automatic control, has a total loading of 6 kW.

A Vickers "Pyramid" diamond hardness testing machine is also demonstrated. Owing to the small load used in making the impression, the machine, besides being suitable for ordinary work, is suitable for testing thin ferrous and non-ferrous strip and case-hardened work. In addition, with the special gear testing attachment, a hardness test can be taken on the pitch circle of the teeth. Another exhibit is a solder bolt heater. This heater is capable of accommodating two 1¼ lb. irons (or their equivalent) in its chamber measuring 6 in. by 5¼ in. by 1¾ in., requires no temperature regulation, and operates on only one kWh per hour.

Crossley Brothers, Ltd.

This company has this year made a special feature of its new vertical compressorless Diesel engine, and two examples are shown, one model (RVD4) being a 4-cylinder engine with a normal rating of 220 brake h.p. at 350 r.p.m. It is shown in operation, and is suitable for power transmission by belt or ropes, or for direct coupling to a generator. The illustration (fig. 8) is an end view with the fuel pump unit in the foreground. The other example is a 3-cylinder vertical Crossley Diesel engine, type OVD3, which has a normal rating of 82 b.h.p. at 450 r.p.m. It is complete with extension shaft and belt pulley for an industrial drive. These two engines have cylinders of 27½ and 55 b.h.p. capacity, respectively, and are built as engines having from one to six cylinders. Suitable compressed air starting equipment is provided, consisting of a direct-coupled petrol engine and compressor with M.S. receiver. They are built upon the enclosed principle, with all moving parts fully protected and fitted with forced lubrication. The valve gear is overhead and enclosed, and the driving chain works within a complete bath of lubricating oil. The fuel pumps are grouped together in one unit, forming a compact and accessible arrangement, and are gear driven, operated by cams mounted upon a short camshaft—all moving parts being subject to bath lubrication. The governor is spring loaded and mounted on the end of the crankshaft, bath lubrication being provided for all pins and wearing surfaces. Numerous accessories are supplied with these engines by the makers as standard equipment, including an oil cooler for the lubricating oil, a thermometer to each cylinder exhaust branch, also a thermometer to each water outlet from the cylinder head. Outstanding features of these new engines is the freedom from vibration, the liberal dimensions of the parts and forced lubrication, which give complete immunity from all bearing troubles. Another feature is the dry crank chamber. All the lubricating oil as it escapes from the rod ends, pistons, &c., is drained away to a sump, where it is filtered and afterwards cooled before being used again. The consumption of lubricating oil is very low.

Berry's Electric (1928), Ltd.

As in last year's Fair this company has erected a steel bungalow on an island site. This is a comfortable form of stand and the darkened interior enables many examples of "Magicoal" fires to be shown to the best advantage. Although these fires again form the principal exhibit, special attention is being drawn to a new line of water heaters which the company has developed. These heaters, one of which

Fig. 9.—A "Canvary" Water Heater.

is illustrated in fig. 9, have been given the trade-name "Canvary" and they possess a number of new features. High thermal efficiency is obtained by means of a special construction enabling the inner container (made of heavy-gauge tinned copper) to be suspended within a liberal thickness of high-grade insulating material, and in no way metallically connected with the outer case. The heating element, central in the container, is of solid construction with fixed embedded wire arranged on its periphery, so that heat generated is rapidly conducted away by the water. The element and the thermostat by which it is controlled, can be withdrawn from the container without emptying it; also the element, thermostat, and mains connector are self-connecting, obviating all internal wiring. A circulating device works in conjunction with the element to ensure an even temperature throughout the cylinder. The whole internal mechanism is mounted on a base which can be easily removed.

Davidson & Co., Ltd.

An exhibit of interest on this company's stand is one of its air washers in operation. Apart from its ability to cleanse thoroughly the air supply in connection with ventilation schemes, this washer also plays an important role in "Sirocco" air conditioning plants, in which relative humidity and temperature control are important factors. The firm also specialises in dust removal installations of every description, and an example shown is a small plant applied to two double-end grinders, the dust being caught by hoods and extracted from the air current by a "Sirocco" collector. Included in a representative range of "Sirocco" fans is a working model of a mine fan, the transparent sides of which allow the visitor to see not only the general design of the fan, but the arrangement and operation of the gear for reversing the air current. A "Sirocco" packer is also shown in operation for packing material in granular or powder form into cases without the application of pressure.

Richard Johnson & Nephew, Ltd.

This exhibit comprises copper products in the form of bars, strips, and wire, in copper, bronze, cadmium copper, aluminium and iron and steel. The bars and strips are in the sizes and dimensions usually taken by manufacturers of electrical products and machinery: wire from ½ in. to 0.0124 in. diameter. Amongst non-ferrous exhibits is "Caduro" cadmium copper trolley wire which, it is claimed, gives approximately three times the life of hard drawn copper with comparatively little reduction in the conductivity. It is of value in power work, both in long spans and pole economy. "Crapo" galvanised wire is also shown. The zinc coating of this wire is perfectly adhesive under all stresses or mechanical blows. There is also a varied selection of sections of all kinds both in non-ferrous metals and steel.

Turner's Asbestos Cement, Ltd.

This company is again showing "Sindanyo" asbestos electrical insulating and arc-resisting materials, and an interesting feature of the exhibit this year is that, following upon the amalgamations in the asbestos industry of the past year, other similar products are shown, *viz.*, "Siluminite," "Ebbinita," and "Macolite." The exhibit includes a variety of "Sindanyo" switchboard panels upon which is mounted electrical equipment by several manufacturers. The large range of shaped parts produced in "Sindanyo" is also shown to advantage. Asbestos paper for electrolytic work, asbestos paper tape for cable insulation and asbestos paper tubes, are displayed, together with a comprehensive group of insulating mouldings of "Siluminite" and "Ebbinita," products hitherto sold by the Siluminite Insulator Co., Ltd., in addition to "Macolite" sheets and mouldings formerly sold by Bell's United Asbestos Co., Ltd.

Birkbys, Ltd.

The principal exhibit of this company is "ELO," a synthetic resin product comprising mouldings, moulding powders, insulating varnish and resin, and in one form or another used largely and increasingly for electrical work, mechanical engineering, scientific instrument manufacturing, &c. It will not soften in heat, and retains its shape and form under all normal and many abnormal conditions. It can be moulded to very fine limits of accuracy. The material has a dielectric strength of from 30,000 to 40,000 V. for ¼ in. thickness. In addition the company is showing samples of variegated "ELO" ware.

Callender's Cable and Construction Co., Ltd.

On this stand there appears a complete range of l.p., h.p., and "super-tension" cables up to and including 66,000 V. The exhibit covers paper, rubber, and cambric-insulated cables, lead-sheathed, armoured, taped and braided; special cables for ship lighting and colliery work; patent rubber cab-tire-sheathed cables, and "Ancalite" cables for railway signalling work, &c., as well as insulating tapes and compounds, and jointing accessories. In addition to cables, Callender's are showing a comprehensive range of electrical distribution appliances, including distribution pillars, network boxes, straight joint boxes, service boxes, frames and covers, &c. The principal items are a 66,000-V single-conductor cable straight-through joint box, shown in section; a 33,000-V 3-core S.L. cable straight-through joint box, in section; unit type distribution pillars; and cut-outs with all-insulated cases. The company is also making a special exhibit of the "Kalibond" system of wiring, which is now in general use all over the country for the electrical wiring of houses, municipal

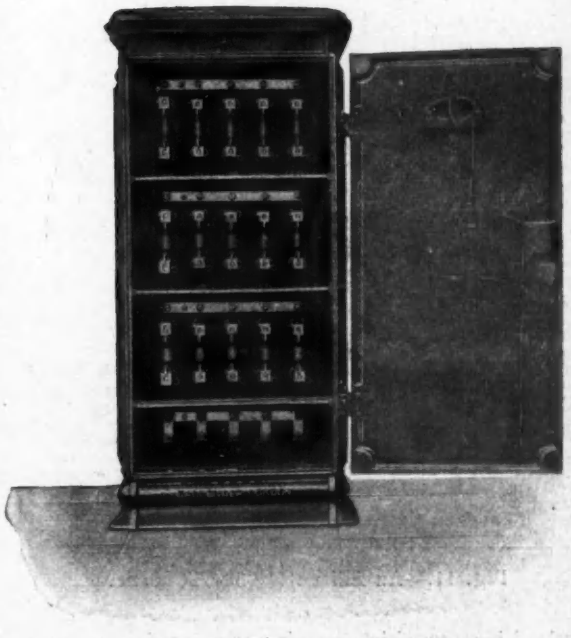


Fig. 10.—A Callender Feeder Pillar.

buildings, banks, hospitals, &c. Samples of the new c.t.s. wiring system with corrosion-proof boxes and lamp fittings are also shown. Another item of interest is "Kalbitum" paint, an anti-corrosive paint for iron and steel work. We illustrate in fig. 10 a Callender unit type feeder pillar embodying the well-known "C.S.W." gear to accommodate five 4-core, 3-phase, l.p. cables.

George Ellison, Ltd.

This is a switchgear exhibit comprising metal-clad cubicle, truck, drop-down and draw-out types of h.p. units for sub-stations; pole-mounting switches for overhead lines; various types of low and medium pressure metal-clad switchboards for industrial installations; totally-enclosed industrial and flame-proof circuit breakers of air-and oil-break types, and a variety of motor starting and controlling apparatus. Fig. 11 shows the company's cubicle type of unit for 11,000-V sub-stations. This design provides good spacing of the component parts, clear runs for connections and easy accessibility. The cubicle construction lends itself to sub-division in any desired manner for the accommodation of any combination of circuit-breaker, isolating switches, meters, instruments, current and potential transformers, and cable fittings. The framework is a strong welded structure which does not depend upon the enclosing plates for bracing. An example of truck-type equipment for 11,000-V sub-stations is another exhibit. This design is a combination of the draw-out and cubicle principles. It is a safe and convenient construction for sub-stations where there is sufficient space to withdraw the truck which carries the circuit breaker and instruments, achieving complete isolation with the advantage of being able to take away the breaker for overhauling. The frame is rigidly welded, the truck runs runs on wheels with ball bearings, the isolated plug contacts are self-aligning and automatic interlocking is arranged to make the truck safe for inspection. The circuit breaker for both cubicle and truck type units is capable of interrupting 150,000 kVA. It is enclosed and pipe ventilated, and its closing and tripping mechanism requires little effort while being sensitive and certain in action. The usual automatic releases are fitted. A pole-mounting overhead line switch for pressures up to 33,000 V is shown. This switch is proof against corrosion and was designed to satisfy the specifications of engineers who have had considerable experience with power transmission lines.

A flameproof oil circuit-breaker is shown on a stand for installations where headroom is limited. This breaker is

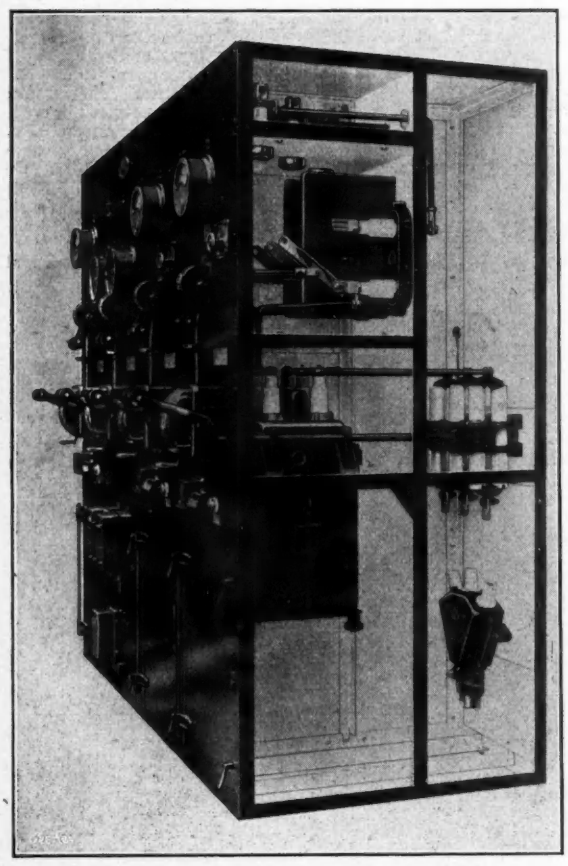


Fig. 11.—An Ellison 11,000-V Cubicle.

enclosed in a flange-jointed cast-iron case, is of high breaking capacity, fitted with all necessary automatic releases and is particularly convenient for armoured or trailing cable connections. Among other gear appearing on the stand are a flameproof air-break circuit-breaker on a skid frame for use in collieries, enclosed in a welded steel case with relief vent; a cable end coupling for simplifying the installation of cables in mines; and switchgear for all kinds of purposes and controlling devices for slip-ring and squirrel-cage induction motors, including star-delta, auto-transformer and resistance starters and drum-type controllers.

Belling & Co.

On this stand is shown a wide range of the company's electric fires, both for domestic and industrial purposes. Amongst the domestic range are some portable designs in several beautiful finishes. A number of new models are shown, including the "Empire" fire which is made with a black or grey non-chip enamel finish. The "Rotunda" fire illustrated (fig. 12) has special "Multi-Parabola" firebars so that the heat is distributed over a very wide area in a semi-circle, while the ventilated back above the dome creates a circulation of warm air throughout the room. For industrial purposes

Fig. 12.—The "Rotunda" Fire.

there are totally enclosed and fireproof air warmers, pipe heaters and electric hot water radiators. The section devoted to cookers, ranges from the "Baby-Belling" cooker, suitable for small families, to full-size models. Demonstrations are given of the "Parmotor" relay. This is a device for automatically controlling electrical circuits. It has a wide range of applications, including the thermostatic control of electric water heaters, cookers, electrically heated rooms, street lighting control, &c. Other interesting exhibits include a new series of enclosed type boiling rings, and imitation coal fires.

Bulpitt & Sons, Ltd.

This firm is showing storage water heaters. The loading of the 10-gallon size heater is only 0.75 kW, while the loading of the 15-gallon tank is 1 kW. Temperature is adjustable by the thermostat setting, and can be varied between 120 deg. F. and 200 deg. F. An immersion heater of an improved and robust type is employed, operated at a relatively low heat to ensure long life. It can be removed by the simple operation of releasing the element from its containing tube by turning a cap with a bayonet joint, which allows the porcelain former and heater to come away bodily without breaking any water joints. The thermostat is of a new type, giving increased sensitivity, and operates the mercurial switch by means of a bi-metallic spiral strip. A single casting at the base of the inner container carries the whole of the fittings, such as water inlet with a non-return valve, heater, thermostat, and porcelain terminal block. This plate is removable and allows access to the inside of the container for purposes of cleaning out or scaling when necessary. Other exhibits include several sizes of "Swan Brand" electrically-operated steam cookers, with which three or four separate dishes may be steamed continuously with a loading of 300 watts.

J. H. Tucker & Co., Ltd.

Among the new products shown by this company, many of which are being placed on the market concurrently with the opening of the Fair, is the "Tucker-Titan" 5-A "all-insulated" tumbler switch with moulded "Telacite" cover on a porcelain base. It is available in all-brown, all-white or brown-on-white for surface or semi-recessed mounting. A quick-make and quick-break movement is fitted embodying a compete positive drive from the "dolly" to the contacts. The covers are not screwed on as in the ordinary tumbler pattern, but are fixed by two screws coloured to match the cover of the switch and permanently attached to the cover to prevent their being lost. Other new exhibits include a series of H.O. type, 60-A d.p. and s.p. watertight and non-watertight cut-outs at competitive prices, and switches for use with these; new designs in brown moulded "Telacite" switchplates; an American-pattern 5-A tumbler switch for flush mounting; a new series of 5-A disk and side-handle operation quick-make-and-break, and also link action watertight switches; and a 15-A s.p. quick-make-and-break foot-press skeleton-type heater switch mounted on a steel frame, no porcelain being employed.

Among the standard lines shown is a complete range of the "B.4000" type tumbler switches in 5 and 15-A sizes, one and two-way, surface, sunk and semi-recessed patterns, with metal or insulated covers and dollies in the usual standard finishes. Also, a duplication of this range but of the solid

link type with the addition of a complete set of special-purpose switches. All the company's latest designs in flush switchplates, including examples made of white "Telacite" throughout, are shown; sixteen finishes are standardised for the metal plates, but any special finish can be produced. In addition to their standard wood and china sockets and plugs, Messrs. Tucker are exhibiting a complete range of 2, 5, and 15-A, 2 and 3-pin sockets and plugs, in wood, china, and moulded "Telacite" to B.S.S. Nos. 73 and 317. A particularly noteworthy feature of the three-pin pattern is the fitting of the earth terminal inside the socket cover, thereby protecting it from damage, but allowing it to be seen when the socket is fixed in position. Other exhibits include "Kwikwire" lampholders, push-bar lampholders, cord grip screwed and batten patterns, in metal and "all-insulated" types; ironclad switch- and fuse-gear in 15, 30, 60, and 100-A capacity, 2, 3, and 4-pole; service entry cut-outs; a complete range of ironclad and teak fuse and distribution boards; switch splitter units up to 4-way with 30-A switch; cooker control units, &c.

Hollings & Guest, Ltd.

The exhibits of this company include samples of its hydraulic presses, pumps, valves, accumulators, &c. The exhibit which is of chief interest to the electrical industry is a four-column press fitted with hot-plates specially designed for the manufacture of "Bakelite" mouldings and insulating materials of all kinds. The three hot plates are made of steel and the steam supply is connected by flexible steam pipes. A comprehensive exhibit of "Bakelite" mouldings are also shown on the stand of the Ellmar Mouldings Co., a subsidiary. These are specially suitable for the manufacture of wireless parts, magneto fittings, all kinds of insulating materials, motor cycle and motor car accessories, advertising novelties, &c. They are produced in various shades of colour.

Chloride Electrical Storage Co., Ltd.

Storage batteries for a variety of electrical purposes are exhibited by this company, whose works at Clifton Junction, near Manchester, is claimed to be the largest battery manufactory in the British Empire. The batteries shown fall into four main categories. The first comprises "Chloride" batteries for stationary installations, such as country house lighting plant and central power stations, and for marine work. These are also designed for the emergency lighting equipment of theatres, kinemas, shops and public buildings. The next class are "Exide" batteries for radio valve anode and filament purposes, talking-film installations, and sound-projector systems. These include a comprehensive range of unspillable cells for portable wireless sets, and also

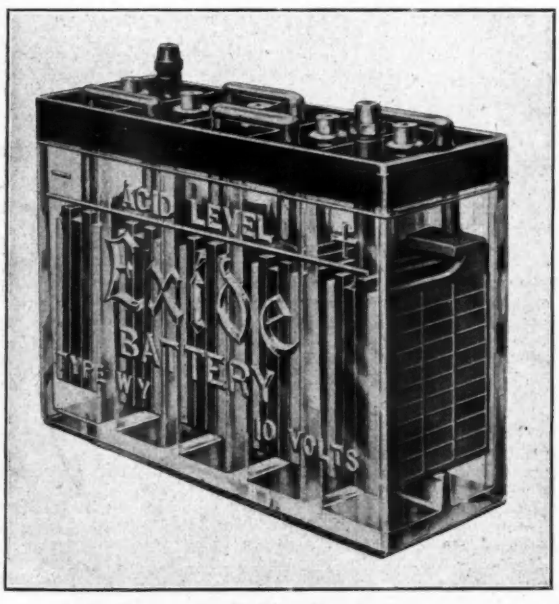


Fig. 13.—An "Exide" h.t. Unit.

unspillable cells for miners' handlamps. One of the "WY10" units is shown in fig. 13. "Exide-Ironclad" batteries for marine work form the next group, and batteries for land traction, such as the propulsion of electric vehicles, trucks and cranes, are shown. "Lux" batteries for lighting railway trains are the fourth class. Among the particular applications of batteries, attention is drawn to the company's switch-tripping service demonstrated on the stand. A working model of a h.p. switch is shown being tripped by a small battery of "Exide" "Mass" type cells. The "Exide" trickle charger is also displayed.

India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.

This exhibit consists of a range of ebonite manufactures including pumps, taps, containers, &c., and specimens of metal articles lined and covered with ebonite. Of particular interest to those engaged in the chemical and allied trades is the "Silvertown" ebonite-lined centrifugal pump (fig. 14) which can be supplied for belt drive or direct coupled to a motor.

Fig. 14.—An Ebonite-lined Pump.

Many types of hose, rubber and canvas transmission and conveyor beltings are also exhibited.

Jackson Electric Stove Co., Ltd.

As in previous years, this company has an excellent representative display of its cooking and heating appliances. Cookers, of course, form the bulk of the exhibit, among them being the "Overseas" model introduced last year. This is particularly appropriate to the Fair, and it is produced to compete effectively with the American models which have made headway in overseas markets, particularly Australia. It is of handsome appearance, all enamelled, fitted with a drop-down door, and has a grill and two "Sadia" boiling plates. A larger model is the "No. 24D" cooker—a double-oven range suitable for a large household. It has a total loading of 19.1 kW. It is 56 in. in length, and with the addition of two separate hot cupboards its height is 67 in. A still larger cooker is the "No. 48" cabinet, designed to cater for from 14 to 16 persons. The oven is built into a cabinet with a hot cupboard and grill, the whole being mounted on four legs. The total loading is 10.9 kW. The "Jackson Junior" is a low-priced cooker adapted for use in small kitchens. It has an oven space measuring 10 in. by 12 in. by 13 in., with a loading of 1,360 W. A 1,800 W grill boiling plate is provided, and in the "51J." model there is also a 1,500-W

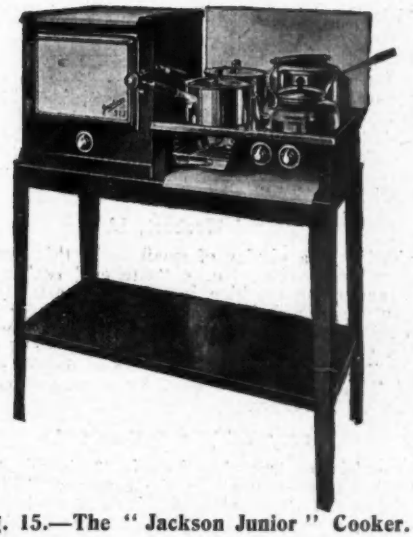


Fig. 15.—The "Jackson Junior" Cooker.

"Sadia" boiling plate. The cooker can be mounted on a convenient table, the top portion then being accommodated as shown in fig. 15. The smallest cooker of the range is the "breakfast" model "No. 61." In addition to the cookers, several examples of "Jackson" water heaters are on view. These are made in lagged and non-lagged types in sizes ranging from 2½ to 25 gal., the loadings rising from 500 to 5,000 W. Thermostatic control is fitted at the purchaser's option, and either single or three-heat switches are provided. The lagged storage water heaters are equipped with a ball-valve tank. The company's wash boilers are shown, as well as the "Perco Wash" spraying device for washing clothes. Grills, toasters, kettles, and immersion heaters also appear. "Jackson" fires are exhibited, and special attention is drawn to the "fabric" finish, obtainable in several colours

Rainsford & Lynes, Ltd.

On this stand is shown a representative selection of electrical accessories and switchgear, the display including lampholders of all types, slow and quick make and break switches, ceiling roses and plates, &c. A new exhibit this year is the company's compensated action switch (fig. 16) which has many unique features. It incorporates in its action a compensated spring device employing three rust-

Fig. 16.—A Compensated-action Tumbler Switch.

less-steel springs. These are so arranged that two dead-centre tension springs are anchored to the moving contacts at one end and to a sliding plunger at the other end, the plunger being acted upon by a compression spring housed in the dolly. As the operating strain is shared by three springs, the life of the switch is considerably lengthened. Other exhibits are switchboards, fuseboards, switchgear, meters, &c. The company is also showing a distinctive range of lighting fittings.

W. Canning & Co., Ltd.

Considerable advance has taken place during the past year in the perfecting and extension of chrome-plating, and the results of this company's research has enabled it to almost double its number of plant installations. Its exhibits include a warm nickel vat complete with rotary air pump for agitating and filtering the warm nickel solution, and oval depassive anodes. Automatic machines for polishing have been designed which show a reduction of 50 per cent. in production costs. A range of low-voltage dynamos and motor-generators especially designed for electro-deposition are also on view. Other exhibits are resistance boards, control panels, shunt regulators, voltmeters, &c., examples of plating barrels, and a large collection of plating, polishing and finishing materials.

British Electrical Development Association, Inc.

At the E.D.A. kiosk, visitors can obtain full up-to-date information concerning the electrical facilities available in any part of the United Kingdom, and a staff is in attendance to deal with all electrical inquiries. In co-operation with the electrical Section Advisory Committee and the Fair Management, the Association has introduced a uniform colour scheme which has been adopted by practically all the firms exhibiting in the electrical section. The Association is circulating a "Guide to the Electrical Section."

Alfred Herbert, Ltd.

In addition to a display of small tools this company is showing a motor-driven No. 6 "Atritor" coal-drying, pulverising and firing machine in operation, actually firing a forging furnace. A similar machine opened up for inspection is also exhibited. The No. 6 "Atritor" has a normal capacity of 500 lb. of pulverised fuel per hour. Samples of work produced by "Atritor" fired furnaces are exhibited, as well as a model "N.O.C." installation for the prevention of scale and corrosion in boilers.

Henry Wiggin & Co., Ltd.

This stand is constructed entirely in "Silveroid," a nickel-copper alloy manufactured by the company. This alloy is also a feature of the display. It rivals silver in colour but possesses the advantage of not being readily attacked by the atmosphere or by many alkalies and certain acids. Electric fires of various makes are shown with "Brightray" elements, and various small resistances and rheostats are also exhibited.

H. H. Vivian & Co., Ltd.

As in previous years, this firm is exhibiting high-conductivity copper tubes, brass or cupro-nickel condenser tubes, copper strip and tape, bus-bars, sections, copper and brass wire, and copper, brass and nickel-silver sheets.

Cellon, Ltd.

This company is showing a complete range of various articles finished with "Cerric" cellulose lacquers, the electrical section including meter cases, reflectors, shades, standard and table lamps, instrument dials, &c.

Berkeley & Young, Ltd.

A comprehensive range of "Bandy" exhaust and ventilating fans is exhibited by this company. It includes marine cabin and saloon fans, slow-speed ceiling fans for theatres and restaurants, box-blade exhaust fans for picture houses, workshops and laundries, oscillating and desk and wall fans for domestic and commercial use, railway carriage fans and special d.c. or a.c. fans for refrigerator work. The ceiling fans are fitted with various types of blades from 9 in. to 48 in. in diameter. Amongst the more recent productions exhibited is the "Ellipso" oscillating fan. The elliptical traversing action of this fan is obtained by means of a single link which is connected to and rotates with a slow-motion shaft. The link is anchored by a universal ball joint to a fulcrum fixed to the base. The reducing gear of 144 to 1 is contained in a simple gear box integral with the motor end cover and fitted with a friction clutch eliminating all chance of damage by anything fouling the guard. The slow-speed ceiling fans include the "08" model for direct current, which has a totally-enclosed motor and is quite dustproof, produced to comply with the exacting conditions of tropical service. In the "Ace" alternating-current ceiling fan, the motor is of the enclosed induction type, fitted with ball-bearings and so constructed as to be grease-tight, fitted with three 54-in. or 56-in. sweep blades. All "Bandy" fans are supplied in a standard finish of three coats of enamel, white or black and gold-lined, but any colour can be supplied to match decorative schemes. Speed regulators for use with "Bandy" fans are also exhibited. These are fitted with from five to seven speeds. Messrs. Berkely & Young have recently perfected an entirely new range of repulsion induction motors from ⅛th up to 1 h.p. and are now contemplating larger sizes. Samples of these motors are shown. A model of a "Bandy" S.P.A.C. lift and crane motor and two models of the "Giljay" battery charger also appear.

Bakelite, Ltd.

This company is exhibiting in both the London and Birmingham sections. Its display is an exceptionally comprehensive one, showing the applications of all "Bakelite" products in many industries. For the first time mouldings made from the new "Bakelite" white moulding material are exhibited. These are particularly suitable as electric light fittings for bathrooms, &c. A special display of large mouldings are shown, together with "Bakelite" laminated sheets, insulating varnishes, lacquers, &c.

G. A. Harvey & Co. (London), Ltd.

The exhibits of this company cover a wide area of patterns of ornamental metalwork for radiator and electric-heater covers, &c. An array of perforated metals, woven wire, steel furniture and equipment for offices, works, &c., is also shown.

Foster Instrument Co.

The major part of this exhibit relates to electrical temperature measurement and automatic control. Another interesting exhibit is the "Resilia" patent system of mounting the moving coil so that it and its pivots are cushioned from shocks, not only axially, but in all directions. This construction when applied to electrical instruments of high precision has advantages when accuracy and robustness are desired in one instrument. Examples of this class of electrical instrument are also shown.

British Electrical Repairs, Ltd.

Repair works have been established by this company in various parts of the country, and on its stand are shown photographs of the various works illustrating the vacuum and pressure impregnation plants installed, together with testing equipment. A map has been prepared to demonstrate the day and night service which the company can give all over the country. Other exhibits include various types of armature, rotor, stator, and field coils, shafts, commutators, bearings, and samples of insulation.

A. P. Lundberg & Sons, Ltd.

The exhibit of this firm includes a wide range of quick-make-and-break and special tumbler switches for lighting and small a.c. and d.c. motor control; also up-to-date types of switch plugs. The "Edgewise" type of flush tumbler switch, for narrow situations, is being developed to provide for most types, among those shown being single-way, two-way, double-pole, intermediate, and "Twinob," two-way with "off" and combined with two-pin plugs (ordinary and automatic). Examples are also shown of improved two-, three-, and four-pin plugs and sockets, fitted with the "Minimex" type of plug, which is adustable for gripping all diameters of flexible wires. Many other types of switches are exhibited, including triple-pole tumbler switches with interlocked three-pin earth plugs, switches for radio work, radio plug connectors, magneto control switches for aeroplanes, and special adapters, pendant switches, &c.

Restlight, Ltd.

This company is displaying for the first time its improved "Restlight" filter screen. A new pattern glass is being used, giving much greater diffusion. All types of lighting fittings are being shown embodying "Restlight" glass, including the new "P.R." model, which is for bedside use, or for desks, bureaux, pianos, &c. The "Lamplough Daylamp" is also being exhibited.

Electrical Imports of Chile.

Statistics for 1927 and 1928.

THE following figures, showing the value of the imports of electrical and allied goods into Chile in 1928 are taken from the recently published official trade returns. The figures for 1927 are also given, together with the increase or decrease in each case.

It will be noticed that substantial increases have taken place in nearly all important lines, but that cables and telephone and wireless apparatus are the only goods in which Great Britain holds a noteworthy share of the trade. The Chilean market for electrical machinery and accessories is expected to expand substantially in the near future. Agricultural, mining and manufacturing activities are all developing, while colonisation schemes are opening up new territory.

	1927. Thous. Pesos.	1928. Thous. Pesos.	Inc. or dec. Thous. Pesos.
Insulators for telegraphs and telephones, &c.—			
Total	427	600	+ 173
From United States ...	243	375	+ 132
,, Great Britain ...	50	75	+ 25
,, From Germany ...	117	140	+ 23
Wire, insulated or sheathed (covered)—			
Total	1,882	4,095	+2,213
From Germany	896	1,290	+ 394
,, United States ...	658	1,805	+1,147
,, Belgium	49	165	+ 116
,, Great Britain ...	135	505	+ 370
Incandescent electric lamp bulbs—			
Total	2,558	3,820	+1,262
From Germany	1,162	1,685	+ 523
,, United States ...	760	1,025	+ 265
,, Holland	247	560	+ 313
,, Great Britain ...	95	80	− 15
Apparatus (various) for electric lighting—			
Total	1,936	1,650	− 286
From United States ...	1,219	610	− 609
,, Great Britain ...	172	175	+ 3
,, Germany	488	800	+ 312
Telephone apparatus—			
Total	2,435	2,140	− 295
From Great Britain ...	1,500	1,080	− 420
,, Germany	352	105	− 247
,, Belgium	168	110	− 58
,, United States ...	180	720	+ 540
,, Sweden	186	7	− 179
,, Switzerland ...	20	75	+ 55
Telegraph apparatus—			
Total	905	2,550	+1,645
From Germany	38	1,127	+1,089
,, United States ...	405	705	+ 300
,, Great Britain ...	433	200	− 233
Wireless apparatus—			
Total	659	3,690	+3,031
From Great Britain ...	59	1,495	+1,436
,, Germany	86	700	+ 614
,, United States ...	419	995	+ 576
,, France	50	134	+ 84
Electric cables—			
Total	3,367	3,535	+ 168
From Germany	319	475	+ 156
,, United States ...	1,905	515	−1,390
,, Great Britain ...	1,120	2,530	+1,410
Electric bells and parts thereof—			
Total	31	85	+ 54
From Germany	16	50	+ 34
,, United States ...	13	24	+ 11
Pipes and tubes, insulated, for electrical purposes—			
Total	162	800	+ 638
From Germany	112	270	+ 158
,, United States ...	28	470	+ 442
,, Great Britain ..	4	3	− 1
Carbons for electrical purposes—			
Total	60	165	+ 105
From United States ...	37	110	+ 73
,, Great Britain ...	9	8	− 1
,, Germany	14	45	+ 31
Dynamos, motors and parts thereof—			
Total	6,873	6,580	− 293
From Germany	1,702	1,610	− 92
,, United States ...	4,456	2,830	−1,626
,, Great Britain ...	479	1,620	+1,141
,, France	58	22	− 36
Electric lamps—			
Total	654	300	− 354
From Germany	264	2	− 262
,, United States ...	351	280	− 71
,, France	17	—	—
,, Great Britain ...	18	7	− 11
,, Holland	4	4	—
Meters—			
Total	659	560	− 99
From Germany	255	240	− 15
,, United States ...	49	95	+ 46
,, Great Britain ...	271	215	− 56
Cells and accumulators—			
Total	2,021	3,035	+1,014
From Germany	164	195	+ 31
,, United States ...	1,660	1,830	+ 170
,, Great Britain ...	169	930	+ 761
Electric fans—			
Total	149	70	− 79
From Germany	11	35	+ 24
,, United States ...	117	18	− 99
Electrical machinery, apparatus and parts (unspecified)—			
Total	6,726	4,490	−2,236
From United States ...	3,235	2,380	− 855
,, Germany	933	1,355	+ 422
,, Great Britain ...	2,477	630	−1,847

[Peso = 6d.]

The New Zealand Electrical Market.

A Very Promising Outlook.

WE have received from the Market Research Department of the Goldberg Advertising Agency, Ltd., Wellington, a study of conditions in the Dominion of New Zealand in so far as they affect the sale of electrical goods. In the first place, it is noted that New Zealand is second only to Switzerland in wealth per head of population. The Dominion leads in respect of imports *per capita*. The water resources of New Zealand are capable of providing more energy than the country can ever use, and under the ambitious Government programme the power needs of the people are being rapidly met by hydro-electric enterprises. The developed water power rose from 54,224 h.p. in 1925 to 149,486 h.p. in 1928, and with the completion of the schemes in hand there will be 454,000 h.p. available. To provide this only six sources of supply have been harnessed. The majority of the homes in the cities are electrically wired, but in most cases for lighting only. Now, however, the people have been impressed by the opportunities afforded by the Government's schemes and are beginning to think electrically. This is illustrated by the figures showing the sale of appliances. For instance, the number of electric ranges in use rose from 9,500 in 1927 to 16,000 in 1928, and at the same time the number of water heaters installed increased from 14,000 to 21,000. The sales are bound to go on increasing at a rapid rate as electricity can compete on favourable terms with gas and coal; moreover, these are only two appliances of many which will find their way into an increasing number of homes.

In industry and agriculture, too, electricity has a very wide field. At present petrol engines are largely used on farms, but the electric motor possesses so many advantages that it will gradually oust this type of plant. The great majority of local manufacturers operate on too small a scale to install steam plant and here again electricity can find a profitable scope. In addition it is considered that the cheap power will induce overseas manufacturers to open up factories in New Zealand instead of exporting their goods to the market. Summarising the position, it may be said that although New Zealand is a small market of 1,500,000 people it is one worthy of the attentions of almost any manufacturer, for those people need and are able to afford so much more of his goods than any other community in the world. Over half of the people are farmers—small farmers on their own land. Many of these have never had electricity before but are now being connected up and are being urged by the Government to use as much as possible in every way, and they have the money to afford what they want. The remainder are city dwellers equally able to afford what they want, but with as yet very little experience of the practical benefits of electricity. If New Zealand only keeps up the progress of the past few years in this line—and those best able to judge are confident that she will do better—she will within three years consume twice the amount of power that she now uses. What she will use that extra power for cannot be accurately foretold. An increased sale of household goods and farm appliances is certain, but it will be the enterprise of individual manufacturers that will determine the exact type of goods that will win the public favour.

The Physical Society's Exhibition—V.*

Annual Display of Electrical Instruments and Scientific Apparatus.

Mr. O. E. Malinverno.

A comprehensive range of relay-graphers, patented and manufactured by Messrs Istrumenti di Misura "C.G.S.," of Monza, Italy, was shown on this stand, including a summation wattgraph integrator exhibited by courtesy of the Electricity Supply Commission of South Africa. This equipment, fig. 1, consists of a standard "C.G.S." motor-operated recorder in which six precision wattmeters of the electrodynamometer type are so mounted as to form three Kelvin balances and control one single combined pointer-pen. The range is 0-45,000 kW, and the instrument is intended to sum up the output of three 3-phase turbo-alternators. The recorder operates also a special form of planimeter, so that, besides a very clear and wide chart showing the instantaneous variations, the instrument also integrates automatically the values of the chart with an accuracy of about 0.2 per cent. At the same time the recorder transmits also the instantaneous indications to two large indicators in the boiler house, and to another indicator in the control room. Through the patented motor-relay system high degrees of accuracy, sensitivity, and dependability are claimed for the apparatus.

A "C.G.S." motor-operated "Frequencygraph" is claimed to be a very sensitive recorder with a very wide scale. It has a range of from 49 to 51 cycles on a scale 6 in. wide, and it is intended for a 110-volt supply. It is independent up to 20 per cent. of voltage variations, and in practice is not influenced by wave form nor by temperature changes. Its sensitivity and its sustained accuracy are highly marked. The chart is of the straight co-ordinate type with uniform divisions; it is 120 feet long, and is driven by an 8-day clock, with a change-over lever for two speeds of 30 and 60 mm. per hour.

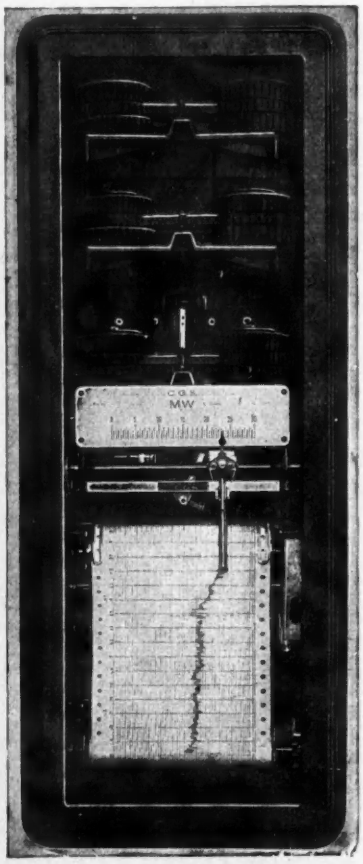


Fig. 1.—Summation Wattgraph-Integrator.

A "C.G." micro-ampergraph exhibited by courtesy of the Department of Industrial and Scientific Research, Radio Research Station, has a scale 6 in. wide, with uniform divisions, and straight co-ordinates for a range of 0-200 microamperes. In this case the motor is for a 50-volt d.c. supply, and the chart speed is 300 mm. per hour. Two specially designed built-in switches with two indices adjustable at any position along the scale are included, so as to operate signalling devices or to provide for the inclusion of an additional resistance, so as to double the range of the instrument.

Fig. 2 is a reproduction of a portion of a "Frequencygram" taken on the stand at the exhibition. The scale is 49-51 cycles and 6 in. wide. The speed of the chart is 60 mm. per hour. It is worth noting that the frequency of the supply was never kept at the rated figure, namely, 50 cycles, because, as it was controlled by an electric master clock it was obviously impossible to detect even large variations if they tended to balance each other or lasted less than about ten or twenty minutes.

* The four previous articles of this series appeared in the January 17th, 24th, 31st, and February 7th issues.

Eversheds & Vignoles, Ltd.

One of the most interesting of this company's exhibits was a working demonstration of the "Megger" earth tester. A model had been constructed of a section of the grid transmission line to show the testing of the earthing of a sub-station, and not only reproducing faithfully the actual type of earth resistance, but showing clearly also the fact that the "Megger" is not affected by back voltage and stray currents. Although the model was a scale one, the full-size instrument was used and conditions were very similar to those encountered in field work.

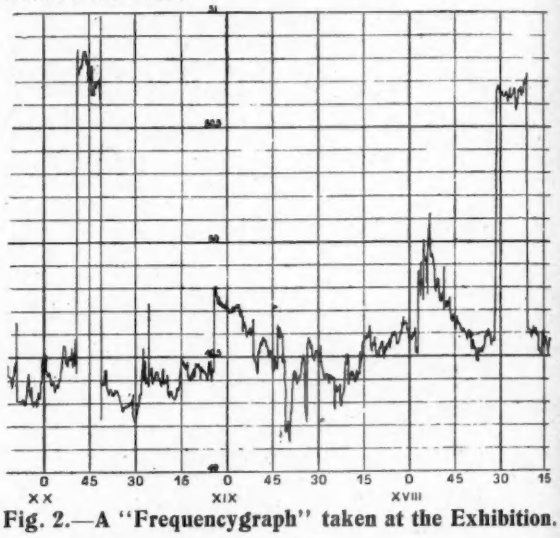


Fig. 2.—A "Frequencygraph" taken at the Exhibition.

The new "Dionic" water purity meter was exhibited both in indicating and recording types. It is of an entirely new type, having automatic temperature compensation without employing a motor-generator or other moving parts.

Foster Instrument Co.

Optical apparatus of novel design was shown for the interior examination of bores and other engineering structures. The system secures a wide angle of view with moderate magnification, and the illumination is arranged in an oblique direction so as to throw inequalities of the bore into high relief.

The automatic temperature control apparatus shown was essentially a recording pyrometer in which the periodic depression of the pen arm, to produce the record, is made also to open and close appropriate relay circuits to control the temperature of the furnace, which is at the same time recorded on the chart. It is frequently desirable to have an enlarged time scale on an industrial recorder when temperature runs are relatively short; the patent "Dial" recorder shown had a circular chart making a revolution once in eight hours, while a dial recorder of normal type was shown making duplicate records, which is frequently valuable when two different persons or departments require the same temperature information. A strip recorder was shown fitted with a non-rotating knife edge, further improving the definition of the record "dot," and it is also provided with a platen under the upper portion of the chart, a convenience when it is desired to write notes on the chart.

Henry Hughes & Son, Ltd.

A magnetic master compass designed to operate any number of repeater compasses at distant stations was shown mounted in its binnacle like a normal compass and compensated in the usual manner; the magnetic element has a standard card and is pivoted in a bowl filled with a non-freezing liquid. The principle on which the repeaters are operated is claimed to be entirely new. An electrical relay controls the repeater switches, the relay, in turn, being controlled by the variation of the electrical resistance of two liquid paths for current within the bowl, which lie between conductors fixed to the bowl and conductors attached to the float of the magnetic element; the four bowl conductors are led in through insulator tubes and are spaced equally round the bowl. When the North point on the card is opposite the lubber line the card conductors are opposite the bowl conductors, and the two electrical paths, bowl and card bowl, are of equal electrical resistance.

Mr. Ernest Turner.

This exhibit illustrated the design and craftsmanship of English-made electrical measuring instruments: milliammeters, galvanometers, ammeters, voltmeters, single and double range, and thermo-couple ammeters. This group of small precision moving-coil instrument is for use in all circuits, d.c. and radio frequency (high and low). The cases are of bakelite with a narrow flange, suitable for either projecting or flush mounting. The dials are of silvered metal, the scales have a 110 deg. arc and are 2 in. long. The overall diameter of the body is approximately 2-1/16 in. All the instruments of this model have a front zero adjuster and are very suitable for small radio receivers and gramophone amplifying equipment, &c. The d.c. and h.f. current-measuring instruments have exceptionally low resistance, while the pressure-measuring instruments' sensitivity ranges from 166 to 1,000 ohms per volt. All the d.c. instruments have a guaranteed accuracy to within 1 per cent., and are capable of withstanding overloads of approximately 500 per cent. of their full-range value for short durations. The high-frequency instruments (thermo-couple) have a safe overload capacity of 100 per cent. of their full square value, are guaranteed to be accurate to within 1 per cent., and the unique design ensures the immediate restoration of the pointer to the zero position on the cessation of current. A range of hot-wire ammeters (expansion type) is made and also various a.c. instruments. An electrical indicator for checking the speed of revolving machine parts consists of a voltmeter, specially calibrated, connected by cable leads of any length to a magneto manufactured by the M.L. Magneto Syndicate, Ltd., of special design and construction to ensure uniform distribution and permanency of output. The equipment is suitable for aircraft, marine, kinema projector apparatus, &c., when very accurate indications of r.p.m. or feet per minute are necessary.

Watson & Sons (Electro-Medical), Ltd.

A time switch has been designed for use in conjunction with a special oil-immersed quick-break contactor for the accurate timing of X-ray exposures. It is operated by a small motor which runs at synchronous speed with the a.c. supply; when the time switch is started the motor engages with the moving system by a small lever, magnetically controlled, and contact is made, closing the relay circuit of the main circuit breaker connected in the high-voltage transformer primary circuit. An aluminium disk carrying a contact is then turned through the number of degrees for which it was previously set, the number of degrees being a measure of the time of the exposure. When the disk reaches the end of its travel, connection is made between the moving contact and a stationary contact. The timer is automatically stopped and the oil-immersed contactor switch opens the main transformer circuit. The oil-immersed contactor is of the double-solenoid type with a sliding core carrying the moving contacts, and the operating solenoids are in circuit only whilst the switch is actually in motion; by this means, the dimensions of the switch are kept comparatively small, and there is no overheating of the operating coils.

The "Sunic" portable diathermy apparatus shown consisted of a high-frequency generator, step-up transformer, condensers, and a spark gap. The machine is used for surgical work only, the tissue being parted by an electric arc which precedes the special operating electrode.

Griffin & Tatlock, Ltd.

Amongst other things the company demonstrated a new field seismometer designed by Dr. J. H. Jones. It consists of a heavy lead cylinder and a light aluminium helm supported by crossed springs and a spiral spring attached to the lead cylinder. The periodic time of the pendulum can be controlled by an arrangement of two magnets mounted on an aluminium framework. The earth movements imparted to the pendulum are magnified by two magnets and a soft-iron element suspended with a phosphor bronze strip, which device is fixed to the aluminium helm. Delicate control of the position of the iron element in the magnetic field is attained by means of an electro-magnetic device.

The Research Association.

The Ninth Annual Luncheon.

THE annual luncheon of the British Electrical and Allied Industries Research Association followed its ninth annual general meeting on February 7th. The function took place at the Savoy Hotel, London, Mr. E. Garcke, president, taking the chair.

Col. Sir THOMAS F. PURVES, O.B.E., president of the I.E.E., after the loyal toast had been honoured, proposed the toast of "The E.R.A." Sir Thomas said that the Institution had had a half-share in the paternity of the Association, and had now become its fairy godmother. No apologies were now needed for research, which was no longer required to show a balance sheet of quick returns. Progress could no longer depend on chance discoveries of science, and industry could only hold its own if allied with organised research into fundamentals; in driving this lesson home the E.R.A. had done yeoman service. The object of the Association, however, contained no word about fundamental science, but that omission might have been made to avoid frightening weaker brethren. Industrial research must always reach upwards into the realm of science, and not *vice versa*; the life blood of industry flowed direct from the heart of pure science.

Mr. E. GARCKE, in responding, paid tribute to the qualities of his predecessors in office and to the services of Mr. Wedmore and the permanent staff of the Association. He claimed that the work of the Association, expressed in monetary terms, had proved of great value. Thus, researches on insulating oil had cost £8,500, but had produced a saving to the industry of about £100,000 per annum, and researches on the heating of buried cables had cost £18,500, but had saved £250,000 per annum and added very considerably to the value of networks in carrying capacity. The incidence of the cost of research should be referred to the finished article, and not to raw material, but all the way through the process there were direct or indirect gains to somebody. The encouraging progress in the collection of funds had enabled them to proceed with confidence in the execution of the stages of research provisionally laid down. Invention was the mother of creation; induction from experience was a necessary counterpart of deduction from general principles, and research must not run too far ahead of a common standard of utility. There was nothing wrong with the British workman; present difficulties were largely a relic of his bad treatment in the 19th century, and co-operation between trade unions and employers was necessary to enable full use to be made of science. Research could never end, and all those benefiting should help the financial resources of the Association. The limitations of research were only those of environment and directive ability; there was no lack of ideas or potential improvements, but there was often a failure in the use made of them by those responsible for the direction of industry.

Mr. R. W. PAUL, proposing the health of the president, referred to his profound studies in philosophy, and his great experience of the electrical industry.

The president briefly returned thanks.

The I.E.E.

Annual Dinner and Reunion.

THE annual dinner of the Institution of Electrical Engineers was held at the Hotel Cecil, London, on February 6th, under the chairmanship of the president, Sir Thomas F. Purves, O.B.E. More than 680 members and guests were present, making it necessary for some to be accommodated in a smaller hall. The guests included distinguished representatives of the principal scientific societies and kindred engineering institutions.

Sir J. H. JEANS, D.Sc., LL.D., F.R.S., following the loyal toasts proposed by the chairman, gave the toast of the "Institution of Electrical Engineers." He referred to the discovery by Michael Faraday, 99 years ago, of the principle of electromagnetic induction as the most important cause of the changes that had occurred during the last 50 years. Those changes had been probably of greater importance in their effect on the conditions of human life than any made during the whole of the stone age. The bearing of Faraday's discovery on the application of electricity was not apparent for many years, and even in 1870 its connection with telegraphy was not appreciated. Recognition of the part that electromagnetic induction was to play was given in the change of the title of the Institution from that of the Society of Telegraph Engineers in 1872, when C. F. Varley, at one of the earlier meetings of the re-named body, boldly prophesied that electricity would take within its purview the whole of nature; that was a year before the publication by Clerk Maxwell of his electromagnetic theory of light, while it was not until late in the eighties that theories as to the electrical structure of matter were put forward. The science of electricity had developed faster than any other pure science, and the I.E.E. had always kept in close touch with the latter. The practical results derived from the study of electrical science had provided an unanswerable argument for expenditure on science generally. One of the greatest honours of his career had been the invitation from the Institution to deliver the Kelvin Lecture; that his subject was one of the more abstract branches of physics showed the breadth of view of electrical engineers. He referred to the presidential address of Sir Thomas Purves as a striking instance of the imagination and insight into science generally to be found among engineers.

The PRESIDENT, responding, said that he had obtained much of his information regarding the Institution through listening to speeches at dinners at the local Centres. The applications of electricity in industry were increasing and becoming diversified. The I.E.E. regarded all the fields of utility as part of one profession, which should be united under one body in the interests of the public, industry, and *esprit de corps*. The various sections enjoyed the same freedom as they would as independent bodies, and the main body of opinion favoured a

constitution flexible enough to provide freedom and also government. Interests sometimes conflicted, but their reconciliation in the interests of a greater whole provided a training in citizenship. The policy of the Institution was to offer an ægis under which any qualified body of electrical engineers could work together, and was comparable with our relations with the Dominions. A relaxation of the standards required for membership was out of the question—any future movement would, in fact, be in the opposite direction—but the Institution was prepared to extend its usefulness to those standing outside. No generation had witnessed a finer panorama of progress than that evident during the past 40 years, accompanied as it was by a widening of the horizon of mankind. Science was the spear-head of engineering, and engineers had a tendency to intellectual honesty which raised them above bias and away from the class-war outlook of the non-engineering mind. The nation could not afford that those upon whom it depended for political direction should not be engineers in that sense.

Capt. J. M. DONALDSON, M.C. (vice-president), proposed the health of the guests. He regretted the absence of the Postmaster-General, who had expected to be present, but was detained at the House of Commons on important business, as that Minister was the titular head of an organisation that was quite half electrical. He referred to the smoke of Battersea as having disappeared, after passing through hot air, like the pylons on the South Downs.

Sir JOHN R. BROOKE, C.B. (Electricity Commissioner), read a letter from the Postmaster-General expressing regret at his inability to be present, and mentioning that the organisation for which Sir Thomas Purves was responsible employed 32,000 men. Telephone subscribers could now communicate with 90 per cent. of all subscribers in the world, and this, with other recent developments, had come about under the supervision of Sir Thomas.

Sir John expressed the view that rule by professional engineers would be a greater tyranny than that experienced under either Fascists or Bolchevists.

During and after dinner a programme of music was given by the British Imperial Orchestra, and the subsequent reunion was once again a very successful feature of the function.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

The All-Electric House.

Mr. Moffett admits in one of his letters that if he used electricity in place of the coke-fired boiler, his domestic staff would be relieved of considerable work. He also adds that if he used purchased electricity for this and other work, his domestic staff would not be reduced. Thus, either he can afford to retain a domestic staff greater than his real needs, or the present staff is overworked. Far be it from me to suggest the latter case; hence Mr. Moffett's case, that of the man who can run a domestic staff on somewhat liberal lines, and indulge his ideas on domestic heating by various means, is abnormal and particular.

Similarly with Professor Parker Smith. The extent of his installation indicates means to do things on a somewhat generous scale, whilst the fact that a very considerable reduction in domestic costs, for labour, is not shown to the credit of the electrical installation, indicates again that the economic factor is not too pressing. Hence this case again is not general.

My own case, and that of several colleagues, is that of the professional man who is comfortable, but must exercise care and place the economic question foremost in all considerations. We require reasonable comfort for our women folk, and as much convenience in domestic affairs as possible. If electricity could not reduce domestic labour very considerably, we could not afford it. The money would have to be spent on help in the home to enable our wives to have reasonable freedom and recreation. By using electricity for heating, cooking, and water-heating, so much work can be saved, so much *hard* work, that the house can be run with only a little assistance, whilst at the same time our women folk have *more leisure*.

In a case like this enormous benefits are obtained from the all-electric house, but the installation must be made with reason and used with intelligence. I am not above carrying a radiator or bowl fire from one room to another, upstairs or down: and I do not use one bar of a 3-kW radiator when a bowl fire will do all I want, either for breakfast, or of an evening in my den.

I have never yet paid £25 a year for my all-electric service, and Professor Parker Smith's cost of £43 is just £3 higher than my rent of £40 a year. Somewhat naturally, therefore, I look upon the £43 account as the privilege of the man who need not be *too* careful. From my own experience, I am convinced that given a much smaller ménage than my own, the "all-electric house" is economically possible, if fitted up according to its room areas, and the installation used with reasonable intelligence.

I am sorry, but I cannot agree with Mr. Moffett on the capital cost question. Even a small self-contained private lighting plant costs £70 to buy and install, and from Mr. Moffett's description, his plant has cost considerably more. Interest on this amount has to be allowed for, and at any rate 5 per cent. depreciation, even if the owner maintains the plant in his spare time. On £70, these two items alone represent £7. For this sum, I get 2,200 units, including the ratable-value charge. If Mr. Moffett can afford to disregard that charge, and if, as he suggests, Prof. Parker Smith's capital charge is higher, then more than ever are these two cases shown to be abnormal.

I do not overlook the losses between the boiler furnace and the energy used in my home. I regret them, as much as Mr. Moffett, but, in spite of all these losses, I find electricity purchased from the mains to be the better *and* more economical method of warming the house and cooking the meals, than either raw coal, coalite, or gas.

W. T. Wardale, A.M.I.E.E.

Sheffield, *February 8th*, 1930.

Motor-convertors as P.F. Correctors.

In reply to "A Mechanic," a motor-convertor is really two machines in one set of apparatus. First, the set acts as a motor-generator; the a.c. end drives the d.c. end mechanically through the shaft, so that the set tends to have the stability of a motor-generator, but at a definite power factor for each load. Secondly, the set acts as a rotary-convertor; the a.c. end is a transformer and the d.c. end is the rotary, the energy being conveyed by the leads in or on the shaft, depending upon whether there is a centre bearing or not. The two direct currents are in parallel and generated in the same coils.

Now the set is designed to generate the "mechanical" energy at a fairly high power factor, but it is the energy generated under rotary-convertor conditions which makes power-factor regulation possible. Hence the effect of over-excitation of the d.c. end is reduced by a fraction depending on the proportion of the energy generated under motor-generator conditions. The ratio between these two energies is fixed for any one set, varying with the design, usually the higher the speed the higher the "rotary convertor" energy.

For the consideration of the effect of over excitation itself might I refer to the excellent correspondence started by "Non-Mathematician" in the issue of the ELECTRICAL REVIEW dated August 9th, 1929.

W. J. Minton.

Ilford, *February 7th*, 1930.

Electrically Undeveloped Areas.

The question of rural electrification and a cheap and abundant supply for everyone in the country has been receiving a good deal of publicity lately. I want to call attention to the fact that there are large tracts of country, outside the areas covered by municipalities, where it seems to be nobody's particular business to look after the interests of electricity supply. The districts to which I refer have no electricity supplies, and, unless some one displays a little energy in the matter, I think it will be a long while before they obtain anything. In most cases large power companies hold control over the districts by Act of Parliament passed years ago, under powers which they have never exercised.

From time to time some industrial concern starts in these districts, makes inquiries of the nearest municipality, and is informed that the place at which energy is required is outside the district controlled by it, after which no one seems to follow up the matter, and the prospective consumer ends by putting in his own plant.

Surely it should be possible to run an intelligence department on a national basis, so that it would be somebody's business to keep an eye on each district and to see that any possible demand of this description would be followed up.

Just at present no one seems to look after these districts, and private plant is being put down in cases where a little investigation would have shown it to be economical to take a supply from a public source, and a rural line serving several villages would probably have resulted.

H. Wilson.

Ashford, *February 7th*, 1930.

Interference with Wireless Sets.

In the ELECTRICAL REVIEW for January 31st "Loud Speaker" wishes to know how ultra-violet-ray apparatus in the neighbourhood of a radio receiver can interfere with reception.

The explanation I offer is that the u.v. ray apparatus produces high-frequency oscillations which induce corresponding oscillations in the radio set.

It is well known that any electric arc, whether between carbon electrodes or in a mercury-vapour tube, will, under certain conditions, generate oscillations which may or may not be of radio frequency. This principle is made use of in the Poulsen-arc system of continuous-wave transmission.

The frequency of the oscillations depends upon the inductance and capacity of the circuit in which the arc is working (which will be constant for a given apparatus), and upon the state of the arc itself, which will vary from minute to minute. When the arc is "singing" the oscillations are of audio frequency, and can actually be heard, whereas an arc working

under slightly different conditions may generate oscillations of a frequency of several hundred kilo-cycles.

I cannot see how a receiver can be rendered immune from such interference, but the earthing of the polished metal reflector of the u.v. ray apparatus might considerably reduce the radiation therefrom.

Norman H. Rigby.

Bolton, *January 31st*, 1930.

With reference to the letter of "Loud Speaker" in the ELECTRICAL REVIEW of January 31st, the machine which causes trouble with wireless receivers mentioned by your correspondent should not be confused with the apparatus for the production of ultra-violet light. The latter type of plant will not affect the working of a wireless receiver.

Undoubtedly the machine to which your correspondent refers is the "violet ray," which is a totally different apparatus. The "violet ray" machine consists of a small high-frequency high-voltage generator, operating a vacuum-glass electrode, which, when energised, gives a violet colour; hence the name. The oscillation frequency of such a machine may be of the order of that used in broadcasting. Part of this equipment consists of a high-frequency transformer, the secondary winding of which is connected at one end to the primary winding, the other end being attached to the vacuum electrode. There is no doubt that this machine acts as a transmitting station, and will interfere with wireless receiving sets within a few hundred yards.

As a general rule, the "violet ray" machine is used for the treatment of hair, and so on, and is operated not more than ten minutes at a time. It is difficult to offer any suggestions as to the method of cutting out interference, short of earth shielding the equipment and the patient on whom the apparatus is being used, as a whole.

H. Gough.

London, W.C.2, *February 6th*, 1930.

Change of System or Frequency.

Can you enlighten us as to the position of a works which has had its motors changed over by a supply authority from d.c. to a.c.? The d.c. motors had a reasonable number of interchangeable parts, such as spare armature coils, brushes, &c., to ensure prompt repairs in case of a breakdown. Should a similar standard of spares be provided by the supply company? The same considerations apply when the frequency changes take place. We should also like to know the position of a contractor, when a frequency change takes place, who has motors and parts in stock for dealing with cases of emergency.

Fairplay.

February 1st, 1930.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

34,735. "Television and like systems." A. Hilger, Ltd. (K. Grant). October 20th, 1928. (324,080.)

1928.

20,225. "Electric protective apparatus." British Thomson-Houston Co., Ltd., F. J. Lane and R. D. Parry. July 11th, 1928. (324,082.)

20,728. "Combination electrode for unipolar high-frequency curative treatment." Dr. E. Treibmann. July 17th, 1928. (324,065.)

25,740. "Apparatus for recording and/or reproducing sound." H. J. Round. September 7th, 1928. (Cognate application, 35,762/28.) (324,027.)

26,201. "Bonding or fixing devices for electric conductors." Edison Swan Electric Co., Ltd., and S. Rogers. September 12th, 1928. (324,066.)

26,641. "Electric remote control apparatus." G. Somajni. September 19th, 1927. (297,360.)

26,908. "Methods and means for the screen projection of acoustic kinematographic films with continuous travel." Soc. des Etablissements Gaumont. November 9th, 1927. (300,235.)

28,417. "Television and like apparatus." J. L. Baird and Television, Ltd. October 3rd, 1928. (324,029.)

28,896. "Supporting devices for use in connection with sound-reproducing apparatus." British Electrical Reproductions Co., Ltd., and C. Berrage-Moulton. October 8th, 1928. (324,032.)

29,177. "Television and like apparatus." J. L. Baird and Television, Ltd. October 10th, 1928. (324,049.)

29,236. "Plug-and-socket connectors for electrical circuits." A. Reyrolle and Co., Ltd., and H. W. Clothier. October 11th, 1928. (324,007.)

29,280. "Anti-vibration mountings for switches, such as are used in automatic telephone systems." Standard Telephones & Cables, Ltd. (L. J. J. Schreiber). October 11th, 1928. (324,008.)

29,608. "Construction of grids, plates, frames, and the like for use in electric accumulators." E. T. Williams. October 13th, 1928. (324,022.)

29,615. "Heat-operated switches." Dr. A. Scherbius and E. R. Ritter. October 13th, 1928. (324,023.)

29,788. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., C. Gilfings and T. G. Rice. October 15th, 1928. (324,094.)

29,794. "Loud-speaking receivers." A. E. C. Snell and F. S. Clifford. October 15th, 1928. (324,095.)

29,795. "Electrical transmission or reproduction of sound." A. E. C. Snell and F. S. Clifford. October 15th, 1928. (324,040.)

29,806. "Automatic electric circuit-breakers." British Thomson-Houston Co., Ltd. October 14th, 1927. (298,917.)

29,853. "Electric level luffing grab cranes." G. A. Atkins. October 16th, 1928. (324,055.)

29,874. "Electric time selective relays and time selective control devices." Nalder Bros. & Thompson, Ltd., and C. L. Lipman. October 16th, 1928. (324,056.)

29,895. "Control of theatre and like lighting systems." R. A. Salaman. October 16th, 1928. (324,097.)

29,923. "Electromagnetic relays." Automatic Telephone Manufacturing Co., Ltd., and H. S. Woodhead. October 16th, 1928. (324,059.)

29,970. "Magnetic sound records." T. McClelland. October 17th, 1928. (324,099.)

29,980. "Multi-conductor ribbon cables and the manufacture thereof." Standard Telephones & Cables, Ltd. (A. L. H. van der Stracten). October 17th, 1928. (324,100.)

29,981/2. "Electromagnetic relays." Standard Telephones & Cables, Ltd., and R. S. G. Terry. October 17th, 1928. (324,074/5.)

30,067. "Electric alternator for use especially as an amplifier." L. Thurm. October 18th, 1927. (298,988.)

30,069. "Luminous vacuum tube devices." J. R. Robertson and J. Vielle. October 17th, 1928. (324,101.)

30,138. "Connections for electron discharge tubes." L. Levy. October 22nd, 1927. (Addition to 291,354.) (299,310.)

30,156. "Cathode-ray oscillograph tubes." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). October 18th, 1928. (324,105.)

30,157. "Telegraph systems." Standard Telephones & Cables, Ltd., and A. A. Clokey. October 18th, 1928. (324,106.)

30,176. "Electric cables." Compagnie Générale d'Electricité. October 31st, 1927. (Addition to 226,771.) (299,772.)

30,217. "Heat-operated safety fuse." A. Scherbius and E. R. Ritter (trading as Scherbius & Ritter). April 14th, 1928. (309,568.)

30,333. "Push-button keys for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd., and S. R. Smith. October 19th, 1928. (324,118.)

30,437. "Time-controlled electric switch." D. L. Chandler. October 20th, 1928. (324,123.)

30,644. "Protective apparatus for electrical power systems." Associated Electrical Industries, Ltd November 21st, 1927. (300,957.)

30,966. "Electrical sound-emitting apparatus." J. Pintsch Akt. Ges. October 26th, 1927. (299,433.)

31,141. "Means for screening electrical apparatus." L. H. Crook. October 26th, 1928. (324,138.)

31,405. "Variable inductances." British Thomson-Houston Co., Ltd. October 28th, 1927. (299,731.)

31,500. "Spark-preventing devices for electric switches." British Thomson-Houston Co., Ltd., and C. C. Devenny. October 30th, 1928. (324,143.)

33,312. "Condenser microphones." P. G. A. H. Voigt. November 14th, 1928. (324,152.)

34,040. "Damper windings for synchronous convertors." L. A. Dreyfus and Allmänna Svenska Elektriska Aktiebolaget. November 20th, 1928. (324,161.)

34,057. "Electric accumulator plates." O. Y. Imray (I. G. Farbenindustrie Akt.-Ges.). November 20th, 1928. (324,163.)

34,064. "Apparatus for generating Röntgen rays." Siemens-Reiniger-Veifa Ges. für Medizinische Technik. June 26th, 1928. (314,369.)

34,118. "Electric fuse or cut-out." Revo Electric Co., Ltd., F. H. Reeves and A. Crawford. November 21st, 1928. (324,165.)

35,730. "Thermionic valves." P. Freedman. December 4th, 1928. (Cognate application, 2,772/29.) (324,175.)

36,182. "Electric oscillation systems controlled by mechanical vibrators." Westinghouse Electric & Manufacturing Co. December 9th, 1927. (301,926.)

37,532. "Telephone instruments." Associated Telephone & Telegraph Co. December 20th, 1927. (302,693.)

38,181. "Advertising or like devices comprising one or more electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). December 27th, 1928. (324,197.)

38,412. "Electric conduit fittings." F. C. Blackwell & Co., Ltd., and F. Firth. December 29th, 1928. (324,202.)

1929.

181. "Variable-speed apparatus for use in systems of secret electrical transmission of signals by wire or wireless." Etablissements E. Belin. January 26th, 1928. (304,763.)

1,866. "Sparking-plug for internal-combustion engines." E. Pernot. January 18th, 1929. (Convention date not granted. (324,226.)

2,508. "Electrodes for electric discharge devices." British Thomson-Houston Co., Ltd. March 2nd, 1928. (307,053.)

2,574. "Method of wireless transmission." C. Lorenz Akt.-Ges. January 26th, 1928. (304,781.)

3,044. "Induction-coil ignition systems for internal-combustion engines." J. Bethenod. March 17th, 1928. (307,911.)

3,619. "Hand-carrier for electric accumulators and the like." W. T. Barnes. February 4th, 1929. (324,244.)

3,729. "Wireless apparatus." V. G. Van Colle. February 4th, 1929. (324,246.)

4,356. "Driving system for alternating-current meters with three-limbed voltage cores and bi-polar current cores." Landis et Gyr Soc. Anon. March 24th, 1928. (308,576.)

5,569. "Apparatus for wireless reception." F. B. Benson. February 20th, 1929. (324,266.)

7,591. "Means for protecting the leading-in tubes in electrical gas purifiers." R. E. Schnorf. March 8th, 1929. (324,281.)

8,065. "High-potential current transformers." Siemens & Halske Akt.-Ges. March 14th, 1929. (307,837.)

8,399. "Electric lampholders." G. P. L. Wells. March 14th, 1929. (324,284.)

16,557. "High-frequency differential transformers." Telefonaktiebolaget L. M. Ericsson. May 30th, 1928. (312,670.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed may be entered within one month from February 5th:—

Tri-Spot (lettering and design). No. 501,514. Class 8. Radio-telephonic apparatus and parts thereof.—H. C. Rawson (Sheffield and London), Ltd., 100, London Road, Sheffield.

Selensor. No. 505,636. Class 8. Telephone mouthpieces.—J. Charman, 24, Benson Road, Waddon, Croydon and Edward F. Entwistle, 69, Fermoy Road, Paddington, W.9.

Madrigal. No. 508,988. Class 8. Radio-telephonic and telegraphic instruments and apparatus and component parts thereof.—Radio Instruments, Ltd., 12, Hyde Street, W.C.1.

Philuma. No. 505,339. Class 13. Electric lamps and electric light fittings.—Naamlooze Vennootschap Philips' Gloeilampenfabrieken, Holland. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Convecto. No 508,534. Class 16 Electric heating elements made chiefly of refractory material.—Chesterton, Jones & Co., Ltd., Rushey Lane, Tyseley, Birmingham.

Opalax. No. 508,952. Class 50. Covers and bases for electric switches and bells, electric light fittings and plugs, &c., made from compositions in which cellulose predominates.—A. W. Kams, 66, Aldersgate Street, E.C.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AUDENSHAW.—Secondary school; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

AYR.—Houses (32), for Corporation (£10,240); burgh surveyor.

AYRSHIRE.—Skating rink at Saltcoats, for G. H. Porteous.

BASINGSTOKE.—Boys' secondary school, for Hants. E.C.; director of education, Winchester.

BATH.—Conversion of skating rink into municipal concert hall (£6,300), for the T.C.; A. J. Taylor, architect.

BEXLEY.—Housing scheme (36), for the U.D.C.; W. T. Howse, surveyor (returnable deposit of £2 2s.).

BILLINGHAM (STOCKTON-ON-TEES).—Public baths, with entertainment hall (£13,642), for the U.D.C.; surveyor.

BIRMINGHAM.—Six-storey block of office premises, on Orthopædic Hospital site; G. Bowen & Sons, Ltd., contractors, Balsall Heath. Cinema and variety theatre, Bearwood Road; H. G. Bradley, architect, 10a, Temple Row. Alterations to showrooms of the Colmore Motor Depôt, Station Street and Hill Street; Edmonds & Co., Constitution Hill. Baths, Kent Road (£75,000); city engineer.

BRAMLEY.—Extensions, St. Mary's Hospital; Leeds city engineer and Board of Guardians.

BRIDLINGTON.—Housing scheme (50), for the T.C.; borough surveyor.

BRIGG.—Housing scheme (100), for the R.D.C.; surveyor.

BURTON-ON-TRENT.—Infirmary extensions for the governors (£20,000); secretary.

CHELMSFORD.—Housing scheme (124), for the T.C.; E. J. Miles, borough engineer (returnable deposit of £2 2s.). Offices and covered 'bus park, Duke Street, for The National Omnibus and Transport Co., Ltd.

CHELTENHAM.—Development, Naunton estate; Naunton Estates, Ltd. Labour exchange; H.M. Office of Works.

CLACTON-ON-SEA.—Senior school (800 places), for Essex E.C.; director of education, Chelmsford.

CORNWALL.—Four schools for the E.C.; director of education, Truro.

DARWEN.—Housing scheme, Marsh House site; baths, borough surveyor.

DERBY.—Extensions, County offices (£13,500), for Derbyshire C.C.; county surveyor.

DONCASTER.—Additions and alterations to West Riding Court House; P. O. Platts, county architect, County Hall, Wakefield.

DUNDEE.—Central 'bus station, for Corporation; D. P. Morrison, transport manager.

EDINBURGH.—Church house and hall at Cathedral (£10,000); Bishop Reid, Glasgow.

ELLESMERE PORT.—Additional 300 houses, for the U.D.C.; surveyor.

FAVERSHAM.—Two schools (£45,000), for the Borough E.C.; clerk.

FIFESHIRE.—School at Kirkcaldy, for education authority (£20,000); master of works, education authority, Kirkcaldy.

GLASGOW.—Hotel (400 bedrooms), Douglas Street and West George Street; city engineer.

GUILDFORD.—Conversion of premises into municipal offices and shops, for the T.C.; borough surveyor.

HARWORTH.—School (500 places), for the Notts. E.C.

HAVANT.—Girls' secondary school, for Hants. E.C.; director of education, Winchester.

HAVERFORDWEST.—Houses (32), for the T.C.; John Morgan, builder, Neath.

HIGH WYCOMBE.—Factory, Hughenden Avenue, for F. Ellis, Ltd.

HULL.—Housing scheme (174 acres), Bank estate. Washhouses, Regent Street (£20,000); city architect.

IRISH FREE STATE (TRIM, CO. MEATH).—Electric lighting and heating installation at Courthouse Buildings, for the County Council; P. J. Duffy, county surveyor, County Hall, Navan, Co. Meath.

KENILWORTH.—Two schools, for Warwickshire E.C.; county architect, Leamington.

KILMARNOCK.—Employment exchange; architect, H.M. Office of Works, 122, George Street, Edinburgh (deposit £1 1s.).

LONDON (WALTHAMSTOW, E.).—Sanatorium extensions (£9,669) and houses and flats, for the T.C.; borough surveyor.

(WEST HAM, E.).—Re-housing schemes, for the T.C.; builders, Perrys (Ealing), Ltd. (£43,102), and Wood Bros. (Builders), Ltd. (£20,027). Extension of Grange Convalescent Home at Harold Wood, for the T.C. (£39,644); A. E. Symes, Ltd., contractors. Welfare centre (£6,000), for the T.C.; borough surveyor.

(BARKING, E.).—Isolation hospital, maternity hospital and clinic; medical officer of health and U.D.C. architect.

(ILFORD, E.).—Houses (146), Fencepiece Road (£65,000); borough engineer. Houses (104), Loxford estate; T. B. Goodwin. Houses (32), Staines Road; E. Glenny and Son.

(CATFORD, S.E.).—Houses (82), Selworthy and Winsford roads; Walter Hall & Sons.

(SOUTHWARK, S.E.).—Reconstruction of Borough Market (£150,000); Market trustees.

(LEE, S.E.).—Houses (102), Baring Road; George Lansdown and Brown.

(SHOOTERS HILL, S.E.).—Extensions, Brook Hospital (£50,000), for the M.A.B.

(ELTHAM, S.E.).—Houses (76), Cambridge estate; W. R. Hindmarsh & Co.

(CLAPHAM, S.W.).—Telephone exchange, Clapham Park; H.M. Office of Works.

(ACTON, W.).—Works extensions, for the Mond Nickel Co., Ltd.

MAIDENHEAD.—Additional 24 houses, for the T.C.; borough surveyor. Bazaar premises, High Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

MANCHESTER.—Houses (392), Newton Heath, Wythenshawe and Blackley; city architect. Assembly hall and recreation room, at Cottage Homes, Styal, Handforth, for the B.O.G.; H. Hargreaves, superintendent of works, Union Offices, All Saints. Central 'bus station; general manager, City Transport Department.

MORECAMBE.—Town Hall (£40,000); borough engineer.

NORTHERN IRELAND (PORTADOWN, CO. ARMAGH).—Central school (1,000 places), for the Armagh Regional E.C.; J. St. John Phillips, architect, 16, Donegal Square South, Belfast.

(BELFAST).—Extension of the Belfast Co-operative Society's premises, York Street; S. Stevenson & Sons, architects, 83, Royal Avenue.

NORTH SHIELDS.—School accommodation (£17,000); Rev. Father Kinleside, St. Cuthberts.

PAIGNTON.—Ten shops, St. Michael's Road; C. & R. Elliott Drew, architects, Dartmouth Road.

PETERBOROUGH.—Two schools (550 places), for the City E.C.; director of education.

PLYMOUTH.—Education offices (£16,000); borough architect. Public school extensions (£24,000), for the E.C.

RETFORD.—Pumping plant and sewage works; borough engineer.

ROMSEY (HANTS.).—Cottage Hospital; Gutteridge & Gutteridge, architects, 9, Portland Street, Southampton (returnable deposit of £2 2s.).

ROTHERAM.—Library (£22,313), for the T.C.; Coe and Lorriman, builders.

SANDY (BEDS.).—Housing scheme (36), for the U.D.C.; housing architect.

SHEFFIELD.—Houses, Wisewood estate; C. W. Alflat (44), and M. J. Gleeson, Ltd. (33). Ultra-violet ray department, and additions to out-patients' department at Childrens Hospital, Western Bank; J. M. Jenkinson, of Chapman & Jenkinson, architects, Imperial Chambers, 18, Norfolk Row.

SMETHWICK.—Cinema (1,300 seats), adjoining Smethwick Market, and billiard saloon, Windmill Lane; W. T. Benslyn, architect, 17, Easy Row, Birmingham. Branch library and welfare centre, Gladys Road and Thimblemill Road; Capt. R. Fletcher, architect, Council House, High Street.

SPRINGHEAD (OLDHAM).—Re-erection of works for the Springhead Varnish Co.

TIVERTON.—Housing scheme (38), for the R.D.C.; surveyor.

WALSALL.—Houses (146), Wolverhampton Road and Lord Street estates (£41,000); A. F. Houfton & Co., Ltd., Mansfield.

WHIXLEY.—Extensions, mental institution; Mid Yorkshire Joint Board for the Mentally Defective.

WOLVERHAMPTON.—Cinema theatre (£100,000), with electrical work, for Leon Salberg; Roland Satchwell, architect, Birmingham.